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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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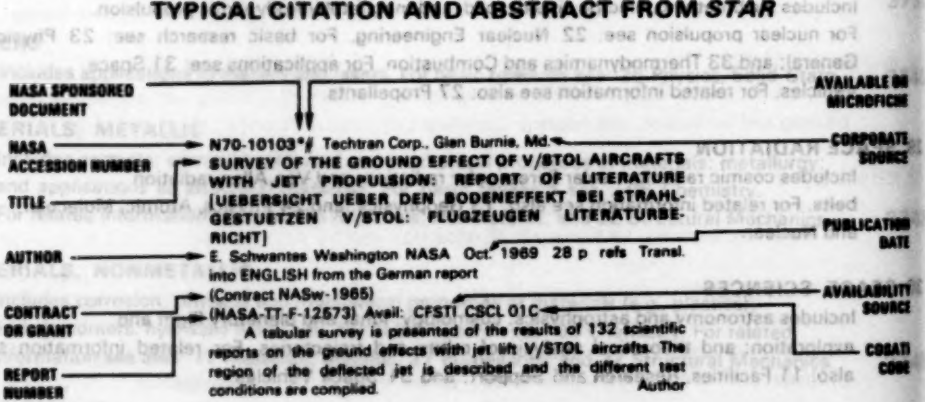
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A tabular survey is presented of the results of 132 scientific reports on the ground effects with jet lift V/STOL aircrafts. The region of the deflected jet is described and the different test conditions are complied.
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VOLUME 8 NUMBER 20 / OCTOBER 23, 1970

Scientific and Technical Aerospace Reports

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Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N70-36285# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

OSCILLATIONS OF A SLENDER PROFILE IN SUBSONIC FLOW NEAR A SOLID GROUND PLANE

R. E. Gibson 15 Sep. 1969 15 p refs Transl. into ENGLISH from Gidrodinamika Bolshikh Skorostei (USSR), no. 1, 1965 p 74–83

(Contract NOw-62-0604-c)

(AD-703995; APL-CLB-3-T-600) Avail: CFSTI CSCL 1/3

An integral equation is derived for a slender wind oscillating in subsonic flow near a solid ground plane. The analysis is an extension of results obtained by Possio. The equation derived lends itself to solution by the small-parameter method. Author (TAB)

N70-36322# West Virginia Univ., Morgantown. Dept. of Aerospace Engineering.

OPTIMUM LOADING ON NONPLANAR WINGS AT MINIMUM INDUCED DRAG

John L. Loth and Robert E. Boyle Aug. 1969 47 p refs

(Contract N00014-68-A-1512)

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A numerical technique was developed for computing the optimum spanwise load distribution on nonplanar wings of arbitrary shape. Munks criterion for minimum induced drag was used. The problem is solved in the two-dimensional Trefftz plane. The two-dimensional shed vortex sheet is assumed to have the same shape as the nonplanar wing from which it was shed. The vortex sheet in the Trefftz plane is subdivided into 2N segments. Each vortex sheet segment is assumed to have a linear vorticity distribution. The velocity induced at N-Q stations is determined with the Biot-Savart law. The problem is then reduced to solving a set of linear algebraic equations. The technique was applied to nonplanar wings with various dihedral angles and locations of the nonplanar wing sections. It was concluded that if the span is the limiting factor then it may be advantageous to use nonplanar wings. On the other hand, if the wing total peripheral length is limited, then the planar wing is always the most desirable configuration, with the highest lift over drag ratio. Author (TAB)

N70-36376*# Chrysler Corp., Huntsville, Ala. Space Div.

CORRECTION OF FOUR-PERCENT SATURN 5 MODEL PROTUBERANCE TEST DATA

George F. McCanless, Jr. 21 Apr. 1970 34 p refs

(Contract NAS8-30517)

(NASA-CR-102819; HSM-R52-70) Avail: CFSTI CSCL 20D

Tests measuring wind tunnel background pressure fluctuations were conducted in the 16 ft transonic wind tunnel. The objective of these tests was to obtain data that can be used to correct Saturn 5 test data. This report describes the preliminary data reduction which is confined to the amplitudes of the pressure fluctuations. Author

N70-36603*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

GROUND-WIND-LOAD CONSIDERATIONS FOR SPACE SHUTTLE VEHICLES

Wilmer H. Reed, III *In its* Space Transportation System Technol. Symp., Vol. 2 Jul. 1970 p 143–160 refs (See N70-36595 20-32)

Avail: CFSTI CSCL 20D

The requirement for reusable space shuttle vehicles to withstand the effects of ground winds poses formidable problems. An attempt is made to identify and focus attention on new areas which are likely to be significant on space shuttle vehicles. Among such problems are: structural fatigue due to the high accumulated wind exposure time on a reusable vehicle; ground handling during erection of large winged vehicles exposed to wind forces; vortex shedding; stop-sign flutter; galloping stability; and possible other wind-induced aerodynamic instabilities associated with the geometric shape of space shuttle configurations. Wind tunnel results obtained from preliminary investigation of galloping stability for models of typical space shuttle configurations are presented. The results indicate the following: wind-induced galloping oscillations could occur on shuttle vehicles within the design ground wind speed range; the lightweight vehicle condition is least stable; and lifting surfaces attached to the body tend to have a strong stabilizing influence on galloping stability. Author

N70-36604*# National Research Council of Canada, Ottawa (Ontario).

WIND TUNNEL SIMULATION OF GROUND WIND SHEAR AND TURBULENCE SPECTRA WITH POSSIBLE APPLICATION TO SPACE SHUTTLE LAUNCH PROBLEMS

R. J. Templin *In* NASA. Lewis Res. Center Space Transportation System Technol. Symp., Vol. 2 Jul. 1970 p 161–175 refs (See N70-36595 20-32)

Avail: CFSTI CSCL 20D

Techniques are briefly described, which were developed for the wind tunnel simulation of low altitude, neutrally stable winds, mostly for nonaerospace structural applications. The three techniques are: Thick turbulent boundary layers simulating the naturally stable ground wind layers are generated over surface

roughness in special wind tunnels with long test sections. An array of shear layer spires was developed which generates thick shear layers in conventional tunnels, with velocity profiles, turbulence in intensity, scale, and spectral shape similar to the neutral wind layer. A technique is being developed for generating turbulent shear layers by means of an upstream array of controllable air jets. Author

N70-36607*# Air Force Systems Command, Wright-Patterson AFB, Ohio. Flight Dynamics Lab.

THE RELEVANCE OF RECENT ADVANCES IN UNSTEADY AERODYNAMICS TO THE SPACE SHUTTLE PROGRAM

Walter J. Mykytow and J. J. Olsen *In* NASA. Lewis Res. Center Space Transportation System Technol. Symp., Vol. 2 Jul. 1970 p 223-237 refs (See N70-36595 20-32)

Avail: CFSTI CSCL 20D

In the last ten years, progress in the linearized theory of unsteady aerodynamics has followed two courses, the improvement of the numerical procedures for isolated lifting surfaces, and later the extension of those methods to include the effects of mutual interference between two or more surfaces and bodies. Several examples of recent progress are given to illustrate that the prediction of steady or unsteady airloads on some complicated configurations, such as components of the space shuttle, can now be performed routinely and accurately. However, technological gaps exist and required research from the space shuttle viewpoint is delineated. Author

N70-36608*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

BUFFET AND AERODYNAMIC NOISE

Charles F. Coe *In its* Space Transportation System Technol. Symp., Vol. 2 Jul. 1970 p 238-247 (See N70-36595 20-32)

Avail: CFSTI CSCL 20D

Buffeting is considered to be the random bending oscillations of overall vehicles and major structural components. Aerodynamic noise (which includes boundary layer noise) is caused by the flow unsteadiness, and is related to the surface pressure fluctuations causing buffeting and local panel response. The main sources of flow unsteadiness causing aerodynamic noise and buffeting are illustrated. The main sources are oscillating shock waves that occur at transonic and supersonic speeds, turbulent wakes, separated flow, attached turbulent boundary layers, vortices and possible flow separation from sharp cornered bodies, interference flows, and transitional flow. The flow over the MSC space shuttle concept in the launch configuration is discussed. However, the same sources of unsteady flow would occur on any configuration for both the launch and reentry phases of flight. Author

N70-36814# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.

AN EXPERIMENTAL INVESTIGATION OF MACH 2.2, TURBULENT BOUNDARY LAYERS IN NOMINALLY ZERO PRESSURE GRADIENT, OCTOBER 1967 - SEPTEMBER 1968

B. Edwards and S. Sivasegaram Oct. 1968 53 p refs

(BL/TN/3) Avail: CFSTI

A small supersonic wind tunnel with a working section 4 ft. long by 12 inches wide and whose flexible roof is approximately 2 inches above the floor for most of its length, is described. Its associated instrumentation, in particular a floating element balance and a form of surface probe for skin friction measurements, is also described. Velocity profile and skin friction measurements, obtained in the turbulent boundary layer on the floor of the tunnel under nominally zero pressure gradient, Mach 2.2 flow conditions, are recorded. The accuracy and reliability of the results are discussed in detail. It is concluded that the tunnel and its instrumentation may be reliably used in cases of near-zero pressure gradient flows. Author

N70-36851*# Grumman Aerospace Corp., Bethpage, N.Y.

ANALYSIS OF WING SLIPSTREAM FLOW INTERACTION

Antony Jameson Washington NASA Aug. 1970 150 p refs (Contract NAS2-4658)

(NASA-CR-1632) Avail: CFSTI CSCL 20D

Theoretical methods are developed for calculating the interaction of a wing with circular and wide slipstreams from arrayed propellers. Rectangular and elliptic jets are used as models for wide slipstreams. Standard imaging techniques are used to develop a lifting surface theory for a static wing in a rectangular jet. The effect of forward speed is approximated by multiplying the interference potential by a scalar strength factor, derived with the aid of studies of the interaction of a lifting line with an elliptic jet. A closed form solution is found for an elliptic wing exactly spanning the foci of an elliptic jet. A continuous wide jet is found to provide a substantially greater augmentation of lift than multiple separate jets, because of the elimination of edge effects at the gaps. With aid of the concept of the apparent mass influenced by the wing, simple formulas are developed for the lift and drag of wings in both wide and circular jets. These formulas provide the basis of a method suitable for engineering calculations. Predictions using this method show good correlation with existing experimental data for wings without flaps. Author

N70-36855*# Oklahoma Univ. Research Inst., Norman.

PLANAR TUMBLING OF BODIES WITH NONZERO AERODYNAMIC TRIM DURING ATMOSPHERIC ENTRY

Final Technical Report, Feb. 1969 - May 1970

Maurice L. Rasmussen May 1970 27 p refs

(Grant NGR-37-003-043)

(NASA-CR-112360) Avail: CFSTI CSCL 20D

An approximate analysis is presented that investigates the effect of nonzero trim on the planar tumbling motion of a vehicle undergoing atmospheric entry. A single extension of a previously analyzed zero trim angle model is used to investigate the motion. It is found when the initial tumbling rate and trim angle are both positive, or both negative, that critical values of these parameters exist for which tumbling motions that are always arrested are separated from those that are not. Quantitative results are obtained on the basis of the approximate analysis. Author

N70-36862# Weapons Research Establishment, Salisbury (Australia).

THE ESTIMATION OF PITCH DAMPING DERIVATIVES OF MISSILE CONFIGURATIONS AT SUBSONIC SPEEDS

M. L. Robinson Jan. 1969 50 p refs

(WRE-TN-HSA-144) Avail: CFSTI

The method, in which a quasi-steady analysis is used, is restricted to small amplitude oscillations and a frequency parameter not exceeding about 0.05. The body damping is considered in two parts, namely a slender body term, and a nonlinear term which arises from flow separation in the cross flow plane. The tail damping contribution is calculated, taking into account the downwash produced by the body vortices. Theoretical results were compared for two different bomb shapes, and reasonable agreement between theory and experiment was obtained. The validity of pitch damping results obtained using shaft-mounted models is discussed. Author

N70-36892*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Environmental Sciences Div.

AEROPHYSICS FACILITIES

In its Space Programs Sum. No. 37-62, Vol. 3 30 Apr. 1970 p 214-222 refs (See N70-36876 20-34)

Copyright. Avail: CFSTI CSCL 20D

Environmental and aerodynamic tests are reported. The test procedure for taking thrust and plume measurements on miniature nozzles in a vacuum chamber are outlined. An experimental program on the aerodynamics of vehicles traveling in tubes is described. The tube is a 70-ft long, 2-inch diam, vertically oriented aluminum tube, and results were obtained at model velocities from

15 to 45 ft/sec under both unsteady and steady conditions. The technique is described for obtaining data on planetary entry flight dynamics of a passive blunt probe. N.E.N.

N70-36902*# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
THEORETICAL CONSIDERATIONS OF SOME NONLINEAR ASPECTS OF HYPERSONIC PANEL FLUTTER Annual Report, 1 Sep. 1968 – 31 Aug. 1969
S. C. Mc Intosh and J. I. Lerner 31 Aug. 1969 54 p refs
(Grant NGR-05-020-102)
(NASA-CR-112668; SU-AR-4) Avail: CFSTI CSCL 01A

Presented is a summary of the fourth year's research activity that has been divided into two more or less independent areas: (1) a study of the effects of aerodynamic nonlinearities on panel flutter at hypersonic speeds; and (2) an attempt to determine theoretically the effects of a turbulent boundary layer on the aerodynamic loading of an oscillating panel. The present study is aimed at improving existing theories to the extent of including all important effects while avoiding unnecessary complication in representing the boundary layer. Author

N70-36986*# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
A COMPARISON BETWEEN EXPERIMENTAL DATA AND A LIFTING SURFACE THEORY CALCULATION OF VORTEX INDUCED LOADS
Wayne Johnson Aug. 1970 23 p refs
(Grant NGR-22-009-303)
(NASA-CR-112769; ASRL-TR-153-2) Avail: CFSTI CSCL 20D

A comparison is made between experimental data and theoretical calculations using a lifting surface theory solution for the loads induced by a free vortex on a single-bladed rotor operating at high advance ratio. Good correlation between experiment and theory is obtained when the vortex is not close to the rotor hub. Author

N70-37030*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERODYNAMIC CHARACTERISTICS OF VEHICLE BODIES AT CROSSWIND CONDITIONS IN GROUND PROXIMITY
Kalman J. Grunwald Washington Aug. 1970 141 p refs
(NASA-TN-D-5935; L-7088) Avail: CFSTI CSCL 20D

A series of force tests was conducted on unpowered, high-speed ground-vehicle model configurations to provide information on shapes of this type very near the ground. Of particular interest were the crosswind effects on the aerodynamic forces and moments of the six models tested. These tests were conducted over the moving-belt ground plane in the 17 foot test section of a 300 MPH 7- by 10-foot tunnel at free-stream dynamic pressure values of 10 lb/ft sq. The results indicate that the half-circle configuration is desirable because of the low rolling moments it experienced; however, it did have higher lift values than the other configurations and, from a utility standpoint, could be impractical. The half-circle configurations with extended sides may make good compromise configurations. All the ground-simulation techniques employed; moving ground belt, fixed ground belt, and image model, gave reasonable representations of the overall aerodynamic trends. Author

N70-37071# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
FREE-FLIGHT MEASUREMENTS OF PRESSURE AND HEAT TRANSFER ON THE LEE SURFACE OF A DELTA WING AT INCIDENCE (M = 1.0 TO 3.6)
G. H. Greenwood London Aeron. Res. Council 1970 46 p refs Supersedes RAE-TR-68246; ARC-31081
(ARC-R/M-3625; RAE-TR-68246; ARC-31081) Copyright. Avail: CFSTI; HMSO £1 3s; BIS $3.78

Pressure and heat-transfer measurements have been made on the lee surface of a delta wing at 14 degrees incidence in free flight over a Mach number range of 1.0 to 3.6 and at free-stream Reynolds numbers between 6 and 24 millions based on centreline chord. A comparison is made with the results from a previous free-flight model test to assess the effect on the lee surface pressure and heat transfer of a change in sweepback angle from 68.9 to 76 degrees. Author (ESRO)

N70-37073# Cambridge Univ. (England). Dept. of Engineering.
AN EXPERIMENTAL INVESTIGATION INTO THE BEHAVIOUR OF THE TURBULENT BOUNDARY LAYER WITH DISTRIBUTED SUCTION IN REGIONS OF ADVERSE PRESSURE GRADIENT
B. G. J. Thompson London Aeron. Res. Council 1970 73 p refs Supersedes ARC-31144
(ARC-R/M-3621; ARC-31144) Copyright. Avail: CFSTI; HMSO £1 17s; BIS $3.78

The developments of seven turbulent boundary layers have been measured on the upper surfaces of three suction aerofoils. Distributed suction was applied, in each case, through a porous plastic suction surface that occupied most of the chord. Good agreement was obtained between the measured development of R sub theta and the predictions of the two-dimensional form of the momentum integral equation when the new skin-friction law taking direct account of the effect of suction was used. The growth of H is predicted very accurately by Head's entrainment approach provided that laminar reversion is absent and that measured H values are used to start the calculations. The simple assumptions for velocity profile shape are found to be inaccurate when the adverse pressure gradients affect the inner region but, before this problem can be tackled satisfactorily, further investigation is required into profile behaviour in the absence of transpiration. Spanwise pitot traverses show that the measured layers are closely two-dimensional. The distribution of suction rate along the chord is also known accurately although surface tube traverses indicate that the supporting structure is partly blocking the suction flow. Author (ESRO)

N70-37079# National Aerospace Lab., Amsterdam (Netherlands).
COMPUTER APPLICATION OF A LINEARISED SUPERSONIC LIFTING SURFACE THEORY ON A CERTAIN CLASS OF WINGS
T. E. Labrujere Jul. 1969 27 p refs Submitted for publication Sponsored by Neth. Min. of Defence
(NLR-TR-G-50) Avail: CFSTI

A computer program was prepared for the determination of the pressure distribution on a thin wing in supersonic flow. The applicability of the program was restricted to cases with completely supersonic trailing edges in the absence of interacting subsonic regions. This report describes the theory, the numerical evaluation, and the computer program and gives some numerical results. Author (ESRO)

N70-37085# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
A METHOD OF CORRELATING THE GROUND EFFECTS ON THE LONGITUDINAL CHARACTERISTICS OF SLENDER WINGS
D. L. I. Kirkpatrick 1970 32 p refs Supersedes RAE-TR-69190; ARC-31798
(ARC-CP-1095; RAE-TR-69190; ARC-31798) Copyright. Avail: CFSTI; HMSO 7s; BIS $1.40

A method of calculating the ground effect on the longitudinal characteristics of a slender wing when the span/height ratio is small is described. The results obtained are compared with those obtained from Gersten's method, valid when the span/height ratio is large. From these two sets of results a method of correlating

the measured ground effects on the normal force and pitching moment on various slender wings is derived, and hence a means of estimating the ground effect on any slender wing at any height above the ground. Author (ESRO)

N70-37138# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
LAMINAR BOUNDARY-LAYER CALCULATIONS COMPARED WITH MEASUREMENTS BY HUMMEL
J. C. Cooke London Aeron. Res. Council 1970 33 p refs Supersedes RAE-TR-67227; ARC-28747
(ARC-CP-1096; RAE-TR-29747) Copyright. Avail: CFSTI; HMSO 8s; BIS $1.70

Calculations by an integral method assuming small cross flow, and by a finite-difference method assuming the flow to be quasi-conical, were compared with measurements made available by D. Hummel (Technical University, Brunswick) on a highly swept delta wing at high incidence. It was found that the small cross-flow method gives a rough general picture of the flow but is inaccurate in details, especially velocity profiles. For this problem the quasi-conical method was more accurate over most of the flow field and gave a much better representation of the velocity profiles. Author (ESRO)

N70-37162# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
LOW-SPEED WIND-TUNNEL MEASUREMENTS OF OSCILLATORY ROLLING DERIVATIVES ON A SHARP-EDGED SLENDER WING. EFFECTS OF FREQUENCY PARAMETER AND OF GROUND
T. B. Owen London Aeron. Res. Council 1970 35 p refs Supersedes RAE-TR-68090; ARC-30623
(ARC-R/M-3617; RAE-TR-68090; ARC-30623) Copyright. Avail: CFSTI; HMSO 18s; BIS $3.60

A sharp-edged wing of gothic planform and aspect ratio 0.75 was oscillated in roll about the wing axis of symmetry, and the oscillatory rolling derivatives determined over a very wide range of frequency parameter. If the frequency parameter is increased until the wavelength of the rolling oscillation is comparable with the wing chord, there is a marked increase of roll damping and reduction of roll stiffness at high incidence. Within the practical low-speed flight range of slender-wing aircraft designs, however, although some reduction of the stiffness derivative below its static value is likely at the highest values of incidence and frequency parameter, the damping coefficient is expected to be sensibly independent of frequency parameter at constant incidence. At practical values of frequency parameter the presence of ground leads to an increase of both roll damping and roll stiffness. While, at 10 to 15 deg incidence, there is little effect of ground if the trailing-edge clearance exceeds 0.4 of the wing span, both the damping and stiffness are more than doubled at a practical touch-down clearance of 0.05 to 0.07 of the wing span. Author (ESRO)

N70-37173# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
A BRIEF ACCOUNT OF SOME UNRECORDED TECHNIQUES FOR FLOW VISUALIZATION IN FLIGHT FOR LOCATING (A) BOUNDARY-LAYER TRANSITION AT ALTITUDE, (B) SHOCK-WAVE POSITION
W. E. Gray London Aeron. Res. Council 1970 13 p refs Supersedes ARE-TR-68188; ARC-30837
(ARC-CP-1090; RAE-TR-68188; ARC-30837) Copyright. Avail: CFSTI; HMSO 3s; BIS $0.70

Flow visualization techniques used in flight tests are described. One indicates boundary-layer transition on a wing with a "china clay coating, that is wetted at high altitude with a liquid of suitable volatility emitted by another aircraft; the result is photographed at altitude. The second shows the shock-wave position by the differential rippling of a viscous oil coating on the wing; at the same time, it also reveals laminar flow areas by unrippled oil. It relies on direct sunlight but is not over-sensitive to its direction. Comparative shock-wave results are given using an earlier direct sun-shadowgraph method which requires precise sun alignment and has been little used. Author (ESRO)

N70-37314# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE LIFT AND SIDE FORCE ACTING ON A BODY IN TRANSONIC FLOW
E. D. Terent'ev [1970] 2 p refs Transl. into ENGLISH from Prikl. Mat. i Mekh. (Moscow), v. 34, no. 2, 1970 p 324–325
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

A lift and side force distribution between the wake and the exterior transonic flow around a body is found for viscous and perfect gases. Radial and tangential gas components are given for the exterior flow along with velocity components from the wake, and a relationship between the constants associated with lift and side forces is shown. Exterior flow in an ideal gas and a viscous gas is compared and shown to agree. The flux of the transverse momentum components, calculated over the part of the control surface which passes through the wake, is independent of the distance from the body at which the surface passes. It is concluded that the momentum flux entrained by the exterior flow is independent of the kind of gas in which the flow is analyzed, and should be identical for both perfect and dissipating gases. J.M.

N70-37395*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECTS OF A POINTED NOSE ON SPIN CHARACTERISTICS OF A FIGHTER AIRPLANE MODEL INCLUDING CORRELATION WITH THEORETICAL CALCULATIONS
Joseph R. Chambers, Ernie L. Anglin, and James S. Bowman, Jr. Washington Sep. 1970 59 p refs
(NASA-TN-D-5291; L-7325) Avail: CFSTI CSCL 01A

An investigation was conducted to correlate the results of theoretical spin calculations with the results of free flight model tests for a contemporary fighter configuration. The study was designed to substantiate the theoretical methods before these methods are applied to studies of the spin and recovery characteristics of the airplane. In order to explain some of the results obtained, however, a series of wind tunnel tests which produced significant information on the effects of a long pointed fuselage nose on spin characteristics was conducted. Various techniques employed in the study included static and forced oscillation wind tunnel tests theoretical calculations, flow visualization tests, autorotation tests, and free spinning tests of dynamically scaled models. Author

N70-37440# General Applied Science Labs., Inc., Westbury, N.Y.
ANALYSIS OF THE NEAR FLOW FIELD FOR TUBE-VEHICLE SYSTEMS Final Report
Sergio Panunzio and Daniel E. Magnus Sep. 1969 58 p refs
(Contract DOT-FR-9-0011)
(PB-188847; GASL-TR-732) Avail: CFSTI CSCL 13F

Results are presented from the investigation of vehicle drag in tube transportation systems. The report emphasizes the analysis of the aerodynamic phenomena in the tube vehicle systems. A simplified one dimensional analysis is formulated for the near flow field. The analysis is applied to several model vehicles, and the results compared with existing data from 19 different experiments. The correlation between the experimental and analytical drag coefficients is good. Also, the dependence of the drag coefficient on various flow parameters is examined and tentative conclusions presented. Author (USGRDR)

N70-37524*# Translation Consultants, Ltd., Arlington, Va.
INFLUENCE OF FLOW TURBULENCE ON THE EFFICIENCY OF HEAT TURBINE BLADE SYSTEMS
J. Elsner and J. Porochnicki Washington NASA Sep. 1970 17 p refs Transl. into ENGLISH from Zeszyty Nauk. Politech. Czestochow. Tech.-Mech. (Czestochowa), no. 3, 1969 p 95-113 (Contract NASw-2038)
(NASA-TT-F-13180) Avail: CFSTI CSCL 20D

The influence of turbulence on the flow through efficiency of turbines is analyzed using experimental data for the energy losses in blade cascades. Subsonic tests show that losses increase for both rotor and stator blades with increasing distance from blade trailing edge. The data demonstrate a sharp influence of initial flow turbulence on the results of wind tunnel tests. Author

N70-37535*# Scientific Translation Service, Santa Barbara, Calif.
THE EFFECT OF THE LAW OF MOLECULAR REFLECTION ON THE AERODYNAMIC CHARACTERISTICS OF BODIES IN A RAREFIED GAS FLOW [O VLIYANII ZAKONA OTRAZHENIYA MOLEKUL NA AERODINAMICHESKIYE KHARAKTERISTIKI TEL V POTOKE RAZREZHENNOGO GAZA]
M. L. Kagan Washington NASA Sep. 1970 10 p refs Transl. into ENGLISH from Vestn. Mosk. Univ., Ser. 1: Mat., i Mekhan. (Moscow), v. 25, no. 1, 1970 p 70-75
(Contract NASw-2035)
(NASA-TT-F-13250) Avail: CFSTI CSCL 01A

A model problem of a rarefied gas flow past a plate is solved for the case when the law governing the reflection of molecules varies continuously from diffusive to one in a direction normal to the surface. Author

N70-37586*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PRELIMINARY ANALYSIS OF A WAKE TRAILING A SPACECRAFT
Walter H. Stafford and John R. Butcher 26 Sep. 1969 32 p refs
(NASA-TM-X-53949; MSFC-IN-ASO-68-3) Avail: CFSTI CSCL 20D

It was formulated that a region exists behind an orbiting spacecraft which is relatively drag free. Due to the interest in conserving propellant on untethered modules flying in formation with a mother spacecraft, consideration is given to inserting the free modules inside the drag-free region. Calculations are made to determine the dimensions of the region trailing a cylinder 600 inches long and 260 inches in diameter. Regions were also calculated for minimum diameters ranging from 200 to 500 inches. The results of the study are presented graphically and in pictorial form. Author

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc.; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N70-36216 National Lending Library for Science and Technology, Boston Spa (England).
THE CONCORDE SIMULATOR
Gilbert Fretigny 24 Jun. 1970 22 p Transl. into ENGLISH from Automatisme (France), v. 14, no. 9, Sep. 1969 p 468-474 In ENGLISH and FRENCH
(NLL-M-9223-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

A Concorde research simulator was installed in a Blagnac laboratory; the principle characteristics of the pilot simulator are given. Precision and ease of piloting was tested in various systems, with emphasis on the Concorde system. The aircraft's stability and handling characteristics, flight control quality, instrumental data, usable visual information, control lay-out and general fittings of the cabin, and the infrastructure were examined. Test results are presented using a pilot as supervisor over a servomechanism. It was concluded that the visual reconstruction system was shown to have image inaccuracies, and its reliability has not reached the standards of the rest of the assembly. J.A.M.

N70-36264# Naval Missile Center, Point Mugu, Calif. Systems Integration Div.
IN-FLIGHT COMPARISON OF THE KAISER FP-50 FLIGHT DIRECTOR WITH STANDARD C-131 INSTRUMENTS
K. D. Cross and A. C. Bittner, Jr. 11 Mar. 1970 30 p
(AD-702748; NMC-TP-70-10; JANAIR-690412) Avail: CFSTI CSCL 1/4

Results of a limited and exploratory in-flight comparison of the Kaiser FP-50 Flight Director with standard C-131 instruments are given. The flight director was installed in a modified C-131 airplane that was piloted by two experienced naval aviators. Data were collected and analyzed on errors associated with altitude, heading, pitch, and roll maintenance. Author (TAB)

N70-36265# Naval Ammunition Depot, Crane, Ind. Research and Development Dept.
MK-45 AIRCRAFT PARACHUTE FLARE OPTIMIZATION PROGRAM PRELIMINARY EVALUATION OF EXPERIMENTAL PARACHUTES AND PARACHUTE MATERIALS FLIGHT TEST SERIES NO. 1
Clenneth R. Koch Nov. 1969 28 p
(AD-702752; NAD-CR-RDTR-163) Avail: CFSTI CSCL 1/3

This report depicts the results of MK 45 Aircraft Parachute Flare flight tests (experimental parachutes) conducted at Naval Weapons Center, China Lake, California, on 26 June 1969 through 7 October 1969. This work was performed as authorized by AIRTASK NO. A05-532-057/323-1/W4703-03. Data obtained from these flight tests indicate the cross type parachute possesses the most advantageous characteristics for incorporation into MK 45 Aircraft Parachute Flare. Author (TAB)

N70-36288# International Business Machines Corp., Poughkeepsie, N.Y. Systems Development Div.
HOLOGRAPHIC HEAD-UP DISPLAY Final Technical Report, 4 Jun. 1968 - 27 Mar. 1970
Thomas J. Harris, Rodman S. Schools, Glenn T. Sincerbox, David W. Hanna, and Dennis G. Delay 27 Mar. 1970 110 p refs
(Contract N00014-67-C-0453)
(AD-703683; JANAIR-680709) Avail: CFSTI CSCL 1/4

A head-up display system as used by an aircraft commander must provide a simulation of the real-world exterior to his vehicle, and, at the same time, represent any change in his attitude with respect to a predetermined segment of this real world. In the particular case of an aircraft landing approach, one can characterize the pilots view of the aircraft carrier and its subsequent variations into six degrees of freedom. The display must provide the view corresponding to the instantaneous values of these parameters and change as any one or more of the parameters change. This report describes the results of a continuation of the development work initiated in Phase I of the contract on displays of this type using sideband or carrier-frequency Fresnel holographic recorded images. The goals of Phase II were to study the various modes and techniques derived in Phase I and other possibilities, to select the approach that offered the best potential for use in Navy

carrier-based aircraft and to build a laboratory model of this selected system. The selected approach uses a GaAs injection laser diode light source to interrogate a hologram of an aircraft carrier model. The real image from the hologram is optically relayed to a special IR vidicon, and the image is then transmitted electrically to a CRT monitor. Author (TAB)

N70-36309# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CERTAIN ASPECTS OF METHODOLOGY OF ECONOMIC INVESTIGATIONS IN THE APPRAISAL OF AIRCRAFT SYSTEMS

S. A. Sarkisyan 3 Nov. 1969 31 p refs Transl. into ENGLISH from Tr. Aviatsionnyi Inst. (Moscow), v. 168, 1967 p 87–110 (AD-703162; FTD-MT-24-284-69) Avail: CFSTI CSCL 15/5

In view of the diversity of the existing aircraft systems, it is necessary to select optimal variants of these systems for the performance of specific (standard) operations; here optimality is construed as the solution of transport problems at minimum expenditure of labor and equipment. The selection of aircraft systems and the determination of the quantitative ratio between various systems of this kind must be carried out early in the design stage to assure a rational distribution of capital investments as well as to accelerate the production of the necessary types of aircraft. In this connection, certain general indicators of the economic effectiveness of aircraft are considered. These criterions may be divided into three groups: technical, technological and economic. The technical and technological indicators condition the level of transport efficiency of the aircraft systems and, together with the economic indicator, they determine the criterion of the economic effectiveness of the system, namely operating cost. The term operating cost in theory can be applied only with respect to specific aircraft systems, e.g. to agricultural aviation, which takes a direct part in the production process, to transport aviation, which serves production etc. Author (TAB)

N70-36384# Trans-Sonics, Inc., Burlington, Mass.

HELICOPTER LIFT-MARGIN SYSTEM, VOLUME 1 Final Report

Vernon C. Westcott and Sidney B. Williams Feb. 1969 45 p (Contract N00014-68-C-0300)
(AD-704601; JANAIR-690107) Avail: CFSTI CSCL 1/4

Helicopter power requirements are generally maximum when hovering out of ground effect (at least for speeds less than 100 knots). Thus takeoff and landing maneuvers are the most critical, since the power requirements may not be clear to the pilot at the time he must make the corresponding decisions. Power deficiencies at takeoff or landing are very hazardous. To maximize safety of takeoff and landing operations, a system has been devised which presents to the pilot his lift margin, a figure which represents the excess weight which could be accommodated under locally-existing barometric-pressure and outside-air-temperature conditions. The system includes two kinds of compensators of which the first corrects available engine torque for ambient conditions and the second makes a similar correction for the ratio of gross weight to required power. Author (TAB)

N70-36463# Naval Postgraduate School, Monterey, Calif.

AN INVESTIGATION OF OSCILLATIONS IN AN ADAPTIVE AIRCRAFT CONTROL SYSTEM UNDER LARGE INPUT COMMANDS

Larry Smith Wisler (M.S. Thesis) Jun. 1969 82 p refs
(AD-705074) Avail: CFSTI CSCL 1/3

An adaptive control scheme for aircraft was studied to find the cause of limit cycles which occurred under large input commands and to find a method for eliminating the oscillations. The complexity of the system equations dictated that all analytical studies be performed on simplified versions of the adaptive control scheme. After exhaustive analysis of the cause of limit cycles in the simplified systems and an investigation of possible fixes for this problem, it was decided that the oscillations were an inherent feature of the control scheme resulting from the servo and actuator lags. A second adaptive control scheme was thus developed which obtained more feedback information downstream of the aircraft actuator and series servo. A comparison of the two adaptive systems was made under similar flight conditions for the F-4 aircraft and the modified adaptive controller was shown to be practical and free of limit cycle oscillations by analog simulation. Author (TAB)

N70-36581# Flying Personnel Research Committee, London (England).

AN ASSESSMENT OF THE AIRCREW EQUIPMENT ASSEMBLIES AND THE TYPE 9 EJECTION SEAT FOR THE HARRIER AIRCRAFT

J. H. Lemon, D. C. Reader, R. Harrison, and A. T. Prescott Nov. 1969 35 p refs
(FPRC/Memo-248) Avail: CFSTI

The type 9 ejection seat for the Harrier aircraft was assessed with various aircrew equipment assemblies and human subjects in a replica of the Harrier cockpit. An assembly using separate parachute and restraint harnesses and two quick release boxes was shown to be unacceptable and was discontinued in favour of an assembly using a parachute torso harness. This latter assembly was shown to be satisfactory. Modifications to incorporate this change are recommended and listed. Author

N70-36636# Civil Aeronautics Board, Washington, D.C.

HOW FLYING GETS BETTER

Whitney Gillilland 1969 13 p refs Presented at Ann. Meeting of the Chamber of Com., Shreveport, La., 4 Dec. 1969
Avail: Issuing Activity

Progress in civil aviation is sketched. Incidences involving the Wright brothers are cited as well as comments on costs and benefits of aircraft and aircraft marketing, air transportation development, and community duties. J.M.

N70-36652# Boeing Co., Renton, Wash. Commercial Airplane Div.

INITIAL DEVELOPMENT OF AN AIRCRAFT HYDRAULIC SYSTEM FLUIDIC CIRCUIT BREAKER

David H. Smith 24 Feb. 1970 22 p ref
(AD-702172; D6-25522) Avail: CFSTI CSCL 1/3

The report describes the initial development of an aircraft hydraulic system circuit breaker for protection against major system leakage in the event of airplane damage. The circuit breaker compares supply and return flows, and all its functions are controlled by hydraulic fluidics. Successful circuit shutdowns were demonstrated, and recommendations are made to bring the unit to flight status. Author (TAB)

N70-36782*# National Aeronautics and Space Administration, Washington, D.C.

AMERICA IN SPACE. THE FIRST DECADE, AERONAUTICS

David A. Anderton [1969] 26 p refs
Avail: CFSTI CSCL 01B

Areas of research and development in the NASA program include not only exploration of space but also continued activities in aeronautics and the advancement of military and commercial aviation. Scientific and engineering disciplines provide substantial support for aircraft programs and contribute to the development of the X-15 airplane, the variable-sweep wing fighter, and the supersonic transport. Work is also performed in the low speed flight regime of helicopters and V/STOL aircraft and evolves in a spectrum of flexible wing configurations. G.G.

N70-36804* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PARACHUTE GLIDER Patent
Alan B. Kehlet, inventor (to NASA) Issued 23 Feb. 1965 (Filed 28 Sep. 1962) 7 p Cl. 244-152
(NASA-Case-XLA-00898; US-Patent-3,170,660; US-Patent-Appl-SN-227683) Avail: US Patent Office CSCL 01C

An aerochute capable of being packed and deployed similar to a parachute is described for controlling the landing of Apollo type spacecraft. Three parachutes are hinged together at three points along the edges of their canopies and the shroud lines from each parachute are gathered and connected to three separate control lines which are attached to a servo system carried by the spacecraft. The aerochute is controllable in pitch by deflection of a control parachute and in yaw by changing the relative positions of adjacent parachutes. The parachutes utilized for yaw control are provided with rudders for stabilization purposes. R.B.

N70-36809# Douglas Aircraft Co., Inc., Long Beach, Calif.
SONIC BOOM MODELING INVESTIGATION OF TOPOGRAPHICAL AND ATMOSPHERIC EFFECTS Final Report, Jun. 1969 – Jul. 1970
A. B. Bauer and C. J. Bagley Jul. 1970 212 p refs
(Contract FA-69-WA-2114)
(MDC-J0734/01; FAA-NO-70-10) Avail: CFSTI

An experimental program was undertaken to study the effects of: (1) topographical and structural shapes on sonic boom focusing, and (2) atmospheric turbulence on sonic boom signatures. These effects were modeled by firing projectiles and allowing the projectile N waves to interact with model shapes and with turbulent jets. The wave interactions were studied by means of shadowgraph pictures and microphone pressure records. The boom focusing parameters were related to the work of Ting and Pan. A canyon model showed wave amplification factors as large as 14 for a special shape and a particular wave direction of propagation. A large amount of statistical information was obtained from the turbulence interactions. This information was found to be in essential agreement with the theory of Crow, but the mechanisms of the shock front breakup and of certain nonlinear features are not understood. Turbulence scaling parameters are used to relate the model results to full scale. Author

N70-36825* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AIRCRAFT WHEEL SPRAY DRAG ALLEVIATOR Patent
Walter B. Horne, inventor (to NASA) Issued 9 Feb. 1965 (Filed 2 Dec. 1963) 8 p Cl. 244-103
(NASA-Case-XLA-01583; US-Patent-3,169,001; US-Patent-Appl-SN-327565) Avail: US Patent Office CSCL 01C

A device is described for alleviating wheel spray drag on dual tandem landing gear operating on runways covered with slush or water exceeding one-half inch depth. Deflector plates are connected to the dual tandem landing gear so that the front wheel fluid spray is prevented from impinging on the rear wheels, resulting in fluid drag reduction on the gear system. Advantages of the deflector include: increase take-off acceleration and performance, minimum effect on aircraft aerodynamic characteristics, simple design, easy installation and maintenance, reliability under adverse runway conditions, and economical manufacturing. J.M.

N70-36871# National Aviation Facilities Experimental Center, Atlantic City, N.J.
CHARACTERISTICS OF FIRE IN LARGE CARGO AIRCRAFT, PHASE 2 Final Report, 1967 – 1970
Julius J. Gassmann Sep. 1970 18 p refs
(FAA-RD-70-42; FAA-NA-70-16) Avail: CFSTI

The degree to which fire in large cargo compartments may be suppressed by shutoff of ventilation was investigated. Results of the tests indicated that this action alone would not protect the fuselage of large cargo aircraft from severe fire damage. Peak air temperatures occurring during fire increased significantly with increasing compartment size from 1,000 to 2,000 cubic feet and were similar with further increase in size to 5,000 cubic feet. Temperatures in the order of 1,800 F were reached in these larger compartments. An increase in percent loading resulted in a more severe fire condition for compartment volumes of all the sizes. A single cargo fire test indicated the use of bromotrifluoromethane at the time of detection and ventilation shutoff may be an effective means of greatly reducing peak temperatures and pressures and providing a longer control time. Author

N70-36942# Bolt, Beranek, and Newman, Inc., Van Nuys, Calif.
NOISE EXPOSURE FORECAST CONTOURS FOR AIRCRAFT NOISE TRADEOFF STUDIES AT THREE MAJOR AIRPORTS Final Report
Dwight E. Bishop and Richard D. Horonjeff Jul. 1970 62 p refs
(Contract FA-68-WA-1900)
(FAA-NO-70-7) Avail: Issuing Activity

The relative effectiveness of three changes in aircraft operating procedures and/or aircraft hardware in reducing noise exposure around three major airports (O'Hare International, John F. Kennedy, and Los Angeles International Airport) were rated by determining the relative change in land areas falling within Noise Exposure Forecast (NEF) 30 and 40 contours. For projected 1975 operations, sets of NEF contours were calculated for changes which included: power cutbacks after take off and two segment approaches for all aircraft, and retrofit of current four-engine turbofan aircraft with either acoustically-lined nacelles or with a quiet engine under development by NASA. At all three airports, substantial reductions in land areas within NEF 30 and 40 contours occurred with retrofits and operational changes; relative area reductions ranged from 30.5% to 59.5%. For operational changes only sizeable reductions (10.5 to 25%) in land areas occurred at Chicago and Los Angeles, but only minor changes were observed for New York. The differences in effectiveness in reducing NEF contours between lined nacelle and quiet engine retrofits were quite moderate, reflecting the increasing influence of noise from other aircraft on NEF values as four-engine turbofan aircraft noise levels are drastically reduced. Author

N70-36968# Weapons Research Establishment, Salisbury (Australia).
ANALYTICAL INVESTIGATION OF SPINNING BEHAVIOUR AND RECOVERY FROM THE DEVELOPED SPIN OF A 60 DEG DELTA-WING AIRCRAFT CONFIGURATION USING A HIGH-SPEED DIGITAL COMPUTER
R. Wilson Sep. 1968 60 p refs
(WRE-TN-HSA-137) Avail: CFSTI

An analytical investigation of the nature of the spin behavior and possible means of recovery from the developed spin for a 60 deg delta-wing aircraft configuration was made using a high-speed digital computer. Details of the computational technique and aerodynamic characteristics of the configuration are described. Author

N70-36967# Federal Aviation Administration, Washington, D.C.
THE NATIONAL AVIATION SYSTEM POLICY SUMMARY
1970 147 p refs
Avail: SOD $1.50

A summary is given for the policies, requirements, goals, and criteria for the development of a national aviation system to be realized over the next 10 years. The plan is oriented toward facilities and functions. These plans are to be incorporated within the limits and constraints of the environment and the resources that are expected to be available. Author

N70-37028# Federal Aviation Administration, Washington, D.C.
THE NATIONAL AVIATION SYSTEM PLAN. TEN YEAR PLAN, 1971–1980
1970 152 p
Avail: SOD $1.50

The National Aviation System Plan contains estimates of the expenditures needed to develop, establish, maintain, and operate the air traffic control, navigation, and associated systems during the 1971–1980 period, and to develop an adequate system of airports. This involves primarily: a) Research and Development Appropriation (R&D) which provides for necessary research, development and service testing; b) Facilities and Equipment Appropriation (F&E) which provides for the acquisition, establishment, and improvement of air traffic control and experimental facilities; c) Operations Appropriation (O&M) which provides for (1) operations, maintenance, and flight check of the ATC system, including administrative expenses for R&D; (2) establishment of facilities; and (3) carrying out the provisions of the Federal Airport Act; and d) Airport Development Appropriation which provides for grants under the Federal-aid Airport Program, grants to state aviation agencies to assist in airport planning and development, and grants to assist planning agencies in airport system planning. Other programs described in the plan include manpower recruitment and training, noise suppression, and aircraft safety and medical research.
E.M.C.

N70-37062# Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.
PRELIMINARY FLIGHT ASSESSMENT OF THE LOW-SPEED HANDLING OF THE BAC 221 OGEE-WING RESEARCH AIRCRAFT
C. S. Barnes and O. P. Nicholas London Aeron. Res. Council 1970 48 p refs Supersedes RAE-TR-67281; ARC-29913
(ARC-CP-1102; RAE-TR-67281; ARC-29913) Copyright. Avail: CFSTI; HMSO 11s; BIS $2.30

The handling of the BAC 221 slender-ogee-wing research aircraft, at speeds down to 114 knots ias and incidences up to 22 deg, is described. The major problems were of lateral/directional control at high angles of incidence when difficulty was experienced in preventing large sideslip angles from building up. At all angles of incidence in the low-speed range, the response to aileron was oscillatory. Longitudinal control was good, but at alpha = 22 deg a mild pitch-up occurred. Aerodynamic buffet increased at this incidence and vortex bursting is thought to have reached forward to the rear parts of the wing. Although approaches were made well below the minimum drag speed, speed control presented no difficulty. Cross-wind take-offs and landings presented no problems except during the ground run. Side-step maneuvers on the approach were made with no difficulty.
Author (ESRO)

N70-37086# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
CIVIL AIRCRAFT AIRWORTHINESS DATA RECORDING PROGRAMME: SOME CHARACTERISTICS OF SEVERE TURBULENCE
G. E. King London Aeron. Res. Council 1970 53 p refs Supersedes RAE-TR-69150; ARC-31835
(ARC-CP-1098; RAE-TR-69150; ARC-31835) Copyright. Avail: CFSTI; HMSO 12 s; BIS $2.40

Severe turbulence characteristics suggested by an initial study of continuous trace records were tested by examining turbulence encountered over a larger number of flying hours. Records from 23,034 flying hours were searched for patches of severe turbulence and those which produced the highest acceleration increments on the aircraft are presented in detail. The largest acceleration increment in a patch was on average 1.3 times the value that would be predicted from a Rayleigh distribution of peaks. About a half of the patches occurred without warning, and examination of outside air temperature data suggests that little additional warning would be provided by a conventional ram air temperature measuring device.
Author (ESRO)

N70-37148# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
AEROELASTIC TEST EQUIPMENT FOR THE CONCORDE SST
Gerard Piazzoli 1970 9 p Presented at the 6th Intern. Symp. on Aerospace Instr., Cranfield, Gt. Brit., 23–26 Mar. 1970 Submitted for publication
(ONERA-TP-811) Avail: CFSTI

The harmonic test method was chosen for the fixed parts of the Concorde structure. Nineteen seismic electromagnetic shakers, of four different types, were located in various parts of the aircraft. The appropriation in flight of the vibratory modes was programmed, as was the sequence of test phases. For the control surfaces the impulse excitation method was preferred. Ten impulse generators of 4000 and 6000 Newton thrust and adapted burning duration, were installed in fairings, in the plane of the control servodynes. The data were processed in the laboratory from magnetic recordings using automatic analogue equipment.
Author (ESRO)

N70-37161# Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.
MEASUREMENT OF THE MOMENTS AND PRODUCT OF INERTIA OF THE FAIREY DELTA 2 AIRCRAFT
C. S. Barnes and A. A. Woodfield London Aeron. Res. Council 1970 50 p refs Supersedes RAE-TR-68160; ARC-30973
(ARC-R/M-3620; RAE-TR-68160; ARC-30973) Copyright. Avail: CFSTI; HMSO £1 5s; BIS $4.95

The moments and product of inertia of the Fairey Delta 2 aircraft have been measured using the method of spring restrained oscillations. The moment of inertia results were satisfactory, but difficulty was found in determining the product of inertia due to unsatisfactory design of the single point suspension rig. A dependence of roll period on roll amplitude was discovered and this may be due to some form of ground effect. The damping in roll was found to vary with fuel state. The agreement between the manufacturer's estimates and the measured moments and product of inertia was poor, and there is clearly a continuing need for inertia measurements. Simple estimates of the fuel inertias compared well with the measured values, agreement being within the expected accuracy of the measurements. The fuel load of the Fairey Delta 2 is relatively small, and simple estimates for greater loads might be less satisfactory.
Author (ESRO)

N70-37163# Royal Aircraft Establishment, Farnborough (England).
CIVIL AIRCRAFT AIRWORTHINESS DATA RECORDING PROGRAMME. SPECIAL EVENTS RELATED TO AIRSPEED CONTROL PRACTICES (FEBRUARY 1963 TO FEBRUARY 1966)
A. W. Cardrick and K. D. Mephan, eds. London Aeron. Res. Council 1970 62 p refs Supersedes RAE-TR-69113; ARC-31672
(ARC-CP-1088, RAE-TR-69113; ARC-31672) Copyright. Avail: CFSTI; HMSO 15s; BIS $3.20

Since October 1962 continuous trace records of airworthiness data have been taken from a small number of aircraft in normal airline service. Throughout the recording period the records have been searched for unusual occurrences, and each of these has been studied to determine its nature and, where possible, its cause. This report describes a selection of events related to airspeed control practices which were detected in records taken between February 1963 and February 1966, and a study of exceedences of airspeed limitations.
Author (ESRO)

N70-37164# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
LOW SPEED FLIGHT TESTS ON A TAILLESS DELTA WING AIRCRAFT (AVRO 707B). PART 2: LONGITUDINAL STABILITY AND CONTROL
W. G. A. Port and J. C. Morrall London Aeron. Res. Council 1970 53 p refs Supersedes RAE-TR-67198; ARC-30846

(ARC-CP-1105; RAE-TR-67198; ARC-30846) Copyright. Avail: CFSTI; HMSO 8s; BIS $1.70

Flight tests were made to measure the static and dynamic longitudinal stability, the effect of ground on stability, and the elevator power of the Avro 707B which has a delta wing swept back 44.5 deg. The results were compared with those of tunnel tests. There is a loss of static stability, stick fixed and free, above a lift coefficient of 0.5. Stick force/g at low speed is small particularly at the aft cg position, although no great difficulties were encountered due to this or the lack of static stability during the approach and landing. Author (ESRO)

N70-37172# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.

AIRCRAFT BRAKING FRICTION TRIALS ON A COARSE OPEN GRADED MACADAM RUNWAY SURFACE

E. J. Key and E. M. Minter Jun. 1969 62 p refs

(RAE-TR-69123) Copyright. Avail: CFSTI

Accelerate-brake trials were made on a coarse open graded macadam runway surface, with a Scimitar Mk.1 aircraft to measure braking friction in wet conditions. For comparison, trials were also made on shallow, transverse grooved and ungrooved asphalt surfaces. Although the aircraft had to be given up before the planned test programme was completed, a tentative assessment of the surfaces was made from seven trials. These indicated that the open graded surface realised somewhat higher wet braking force coefficients than either of the other two surfaces, that the wet open graded surface was almost as good as the dry grooved asphalt, and that the grooved surface was no better in wet conditions than the ungrooved. Moreover, the trials showed the necessity of using a test vehicle with a high braking performance and the desirability of nosewheel steering. Author (ESRO)

N70-37177# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.

AIRCRAFT ACCIDENT REPORT: MINERAL COUNTY AIRLINES DBA HAWTHORNE NEVADA AIRLINES DC 3, N1SS70 NEAR LONE PINE, CALIFORNIA, 18 FEBRUARY 1969

4 Feb. 1970 29 p

(PB-189650; NTSB-AAR-70-5) Avail: CFSTI CSCL 01B

The report contains the analysis, findings, conclusions, and recommendations as determined by the National Transportation Safety Board and Applicable to a DC 3 aircraft which crashed while the crew operated under instrument flight rules in high mountainous terrain, in an area where there was a lack of radio navigation aids. The aircraft crashed on the east slope of Mount Whitney all persons on board perished in the impact. USGRDR

N70-37196# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.

AIRCRAFT ACCIDENT REPORT: ALLEGHENY AIRLINES, INCORPORATED, CONVAIR 580, N5802, NEAR THE BRADFORD REGIONAL AIRPORT, 24 DECEMBER 1968

28 Jan. 1970 49 p

(PB-189649; SA-410 ; NTSB-AAR-70-4) Avail: CFSTI CSCL 01B

The report contains the analysis, findings and conclusions, recommendations and corrective measures as determined by the National Transportation Safety Board and applicable to a Convair 580 aircraft which crashed while the crew attempted an instrument approach to runway 32 at Bradford Regional Airport, Bradford, Penn. USGRDR

N70-37241# Royal Aircraft Establishment, Bedford (England.) Aerodynamics Dept.

LOW-SPEED WIND-TUNNEL MEASUREMENTS OF THE OSCILLATORY LATERAL STABILITY DERIVATIVES FOR A MODEL OF A SLENDER AIRCRAFT (HP 115) INCLUDING THE EFFECTS OF FREQUENCY PARAMETER

J. S. Thompson, R. A. Fail, and J. V. Inglesby London Aeron. Res. Council 1970 58 p refs Supersedes RAE-TR-69018; ARC-31289

(ARC-CP-1097) Copyright. Avail: CFSTI; HMSO 13s; BIS $2.60

Low-speed tunnel tests on a model of the HP 115 aircraft provided a complete set of lateral derivatives for a range of frequency parameters. Over a range appropriate to full scale flight, the frequency parameter effects were small, but for very high values there was a marked reduction in some derivatives and there was evidence that the virtual inerties were about the same wind-on and wind-off. Some recent improvements in technique are also described. Author (ESRO)

N70-37242# Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.

ATMOSPHERIC GUSTS: A REVIEW OF THE RESULTS OF SOME RECENT RAE RESEARCH

J. Burnham London Aeron. Res. Council 1970 80 p refs Supersedes RAE-TR-68244; ARC-31113

(ARC-CP-1091) Copyright. Avail: CFSTI; HMSO 13s; BIS $2.60

Recent RAE research has been concerned with severe gusts and the situations in which they occur. In the stratosphere, mountain wave conditions and those in the vicinity of thunderstorm tops have been investigated. At lower altitudes, gusts in and near thunderstorms have also been studied, as have wind and gust effects likely to be significant during take-off and landing. This work has relevance both to aircraft operations and to aircraft design and mathematical models of severe gusts are also described. The effects of pilot control activity during flight through gusts is discussed. Author (ESRO)

N70-37334# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.

AIRCRAFT ACCIDENT REPORT, PUERTO RICO INTERNATIONAL AIRLINES, INCORPORATED DE HAVILLAND HERON 114-2, N563PR SIERRA DE LUQUILLO SAN JUAN, PUERTO RICO, 5 MARCH 1969

24 Apr. 1970 32 p

(PB-191991; NTSB-AAR-70-9) Avail: CFSTI CSCL 01B

The report contains the analysis, findings, conclusions and recommendations as determined by the National Transportation Safety Board and applicable to a De Havilland Heron 114-2. The aircraft crashed in the Sierra de Luquillo mountains while being vectored for an ILS approach to runway 7 at the San Juan International Airport, March 5, 1969. USGRDR

N70-37453# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.

AIRCRAFT ACCIDENT REPORT, NORTHEAST AIRLINES, INCORPORATED, FAIRCHILD HILLER FH 227C, N380NE NEAR HANOVER, NEW HAMPSHIRE 25 OCTOBER 1968

1 Apr. 1970 63 p refs

(PB-191201; NTSB-AAR-70-7; SA-408) Avail: CFSTI CSCL 01B

The report contains the analysis, findings, conclusions and recommendations by the National Transportation Safety Board and applicable to a Fairchild Hiller FH-227C's crash. The aircraft had been cleared for an approach to the Lebanon Regional Airport, West Lebanon, New Hampshire. Included are the investigation and hearings. USGRDR

N70-37486# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.

AIRCRAFT ACCIDENT REPORT: TRANS WORLD AIRLINES, INC., BOEING 707-331, N787TW, NATIONAL AVIATION FACILITIES EXPERIMENTAL CENTER, ATLANTIC CITY AIRPORT, POMONA, NEW JERSEY, JULY 26, 1969

25 Mar. 1970 59 p
(PB-191318; NTSB-AAR-70-8; FILE-1-0017) Avail: CFSTI CSCL 01B

Presented are the analysis, findings and recommendations applicable to a Boeing 707's crash during a simulated three-engine, missed approach. One of the required proficiency check maneuvers included a simulated instrument approach and the execution of the missed-approach procedure, with a critical engine reduced to training idle in order to also simulate engine failure. While this simulated approach was in process, and after the landing gear and full flaps had been extended, fatigue failure of the left outboard spoiler actuator downline caused the loss of hydraulic fluid from the aircraft's utility hydraulic system. Author (USGRDR)

N70-37542*# Translation Consultants, Ltd., Arlington, Va.
COMPARISON OF THE TAKEOFF AND LANDING PERFORMANCES OF JET- AND FAN- VTOL-AIRCRAFT [VERGLEICH VON START-UND LANDELEISTUNGEN STRAHLGESTUETZTER SENKRECHTSTARTER]
H. Herb Washington NASA Sep. 1970 54 p refs Transl. into ENGLISH of DFVLR, Brunswick report DLR-FB-69-61 p 1-42
(Contract NASw-2038)
(NASA-TT-F-13181; DLR-FB-69-61) Avail: CFSTI CSCL 01C

The demand for fast aircraft which could take off and land vertically led to a variety of types of aircraft. The advantages and disadvantages of the individual models are discussed with respect to the arrangement of the engines and the values attained by computing wind tunnel measurements and flight tests are compared. The investigations dealing with the performance of the different models during take-off and landing are presented. Author

N70-37551# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
BRIEFS OF ACCIDENTS BY MAKE AND MODEL OF AIRCRAFT. US GENERAL AVIATION, 1967. VOLUME 1: BEECH 23 AND 25, PIPER 3/PA-11, PA-12, PA-16, PA-18, PA-20, PA-22, PA-24, PA-25, PA-28 AND PA-32
Dec. 1969 719 p
(PB-192067) Avail: CFSTI HC$10.00/MF$0.65 CSCL 01C

The report contains the briefs of accidents involving Beechcraft and Piper aircraft occurring in 1967. Author (USGRDR)

N70-37552# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
BRIEFS OF ACCIDENTS BY MAKE AND MODEL OF AIRCRAFT. US GENERAL AVIATION: 1967. VOLUME 2: CESSNA 120/140, 140-A, 150, 170, 172, 175, 180, 182, 185, 190/195, 205/210
Jul. 1969 686 p
(PB-192068) Avail: CFSTI CSCL 01B

The report contains the briefs of accidents involving Cessna aircraft occurring in 1967. Author (USGRDR)

N70-37553# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
BRIEFS OF ACCIDENTS BY MAKE AND MODEL OF AIRCRAFT. US GENERAL AVIATION: 1967 VOLUME 3: TWIN ENGINE AIRCRAFT: AERO COMMANDER, BEECHCRAFT, CESSNA 310, PIPER PA-23 AND PA-30
Jul. 1969 244 p
(PB-192069) Avail: CFSTI CSCL 01B

The report contains briefs of accidents involvng the following aircraft: Aero Commander twin engine; Beechcraft twin engine; Cessna 310; and Piper PA-23 and PA-30. USGRDR

N70-37554# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
BRIEFS OF ACCIDENTS BY MAKE AND MODEL OF AIRCRAFT. US GENERAL AVIATION: 1967. VOLUME 4: AERONCA 7 AND 11, ERCOUPE, GLOBE GC-1A, NAVION, LUSCOMBE 8, MOONEY MK 20/21, STINSON 108 AND TAYLORCRAFT
Jul. 1969 365 p
(PB-192070) Avail: CFSTI CSCL 01B

The report contains the briefs of accidents involving the following aircraft: Aeronca, Ercoupe, Globe, Luscombe, Mooney, Navion, Stinson and Taylorcraft. USGRDR

N70-37570*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A STUDY ON THE USE OF FIGHTER AIRCRAFT TO PROVIDE A ZERO g ENVIRONMENT IN SUPPORT OF SPACE MANUFACTURING EXPERIMENTS
12 Sep. 1969 39 p refs
(NASA-TM-X-53896; MSFC-R-ME-IN-68-19) Avail: CFSTI CSCL 01C

Systems development in support of space manufacturing and construction require a locally available, low cost, zero g testing method with time/cost variables between the present drop tower and orbital flight. Studies indicate that such a facility can best be provided by minimal conversion of a fighter-type aircraft. The T-38 should be considered the optimal aircraft for conversion; it can produce continuous zero gravity parabolas lasting 1 minute and 20 seconds. For initial conversion, the T-33 aircraft represents the best choice since it is more available and can be modified at a lower cost than the T-38; it is capable of a maximum single parabola time of 35.8 seconds. Removable pods equipped with instrumentation for monitoring of tests under zero g flight are recommended. These pods would be designed to fit available space within the aircraft or fasten to existing attach points external to the aircraft. Costs involved in modifying and operating the T-33 aircraft for zero g experimentation were estimated. Author

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N70-36227# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MATCHING A THERMIONIC CONVERTER WITH A SOLAR CELL IN A SOLAR POWER ARRAY
U. A. Arifov et al 25 Feb. 1970 7 p refs Transl. into ENGLISH from Geliotekhnika, Akad. Nauk Uz. SSR (Tashkent), no. 1, 1969 p 41-43
(AD-704002; FTD-HT-23-42-70) Avail: CFSTI CSCL 10/2

The aim of the report is to determine the possibility of combining a high-temperature thermionic converter with a solar cell with partial use of its outer surface as the cathode with the introduction of the concentrator parameters corresponding to glass projector mirrors. Author (TAB)

N70-36253# Harry Diamond Labs., Washington, D.C.
PLASTIC AMPOULE
John M. Boyd Oct. 1969 27 prefs
(AD-700994; HDL-TR-1471) Avail: CFSTI CSCL 10/3

A study was made of the feasibility of a plastic ampoule for use in a reserve battery. Containers were thermoformed from thermoplastic sheet stock and filled with electrolyte, which was completely encapsulated by heat-sealing a plastic disc of the same

material on top of the container. Conventional techniques were used to plate these ampoules made from a pigment-filled polypropylene exhibited the lowest permeability, which extrapolated to a 5.5-percent loss of water over a 10-yr period at 70C. Author (TAB)

N70-36461# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FUEL ELEMENTS. KINETICS OF ELECTRODE PROCESSES: COLLECTION OF ARTICLES
Yu. A. Chizmadzhev et al 6 Feb. 1970 474 p refs Transl. into ENGLISH from Russian report
(AD-704164; FTD-MT-24-378-69) Avail: CFSTI CSCL 10/2

The collection contains survey articles on the theory of work of fuel elements allowing direct conversion of chemical energy of fuel into electrical. Methods of macroscopic description of porous electrodes are considered taking into account a large number of transport and kinetic stages, model systems, capillary phenomena, kinetics of electrochemical conversions on smooth electrodes. Attention is allotted to the kinetics and mechanism of electroreduction of oxygen on metals-catalysts (metals of the platinum group, silver, nickel and on silver-nickel alloys) widely used in electrochemical generators. The mechanism of oxidation in fuel elements of such forms of fuel as methane, methanol, formic acid and hydrazine is described. TAB

N70-36715*# Perkin-Elmer Corp., Norwalk, Conn.
ACTUATORS FOR ACTIVE OPTICS
Gordon J. Watt *In* NASA, Washington Opt. Telescope Technol. 1970 p 303-306 (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 13I

Considered are basic actuator systems that either produce minute deflections or minute forces for mirror assemblies. The stiffness of the forcing actuator and the compliance of the displacement actuator are combined in a hybrid actuator system where an Invar shaft is passed through a piezo-electric cylinder with an interference fit. Relative displacement between the two is controlled by electric fields; selective voltage pulses between rings distort the piezoelectric material and cause either the cylinder to creep along the shaft or the shaft to be pushed through the cylinder by peristalsis. Actuator motion is obtained by passing a train of voltage pulses from left to right along the cylinder. Interferometric measurements of small mirror displacements at three different pulse voltage amplitudes demonstrate good linearity of displacement curves. G.G.

N70-36778* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FOAM GENERATOR Patent
George F. Look and Frank M. Ballentine, Jr., inventors (to NASA) Issued 29 Sep. 1964 (Filed 2 May 1962) 7 p Cl. 9-8
(NASA-Case-XLA-00838; US-Patent-3,150,387;
US-Patent-Appl-SN-192016) Avail: US Patent Office CSCL 06G

A plastic foam generator connected for fluid communication with an inflatable elastomeric bag or envelope, to be included within a space vehicle payload package designed to land in a body of water, is described. The foam generator includes a casing member sealed at one end and attached to an instrument package. The method of foam production and its function in inflating the elastomeric bag, providing buoyancy for the attached instrument package, are discussed. P.A.B.

N70-36803* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TWO-FLUID MAGNETOHYDRODYNAMIC SYSTEM AND METHOD FOR THERMAL-ELECTRIC POWER CONVERSION Patent
David G. Elliott, inventor (to NASA) Issued 24 Nov. 1964 (Filed 25 Jul. 1962) 8 p Cl. 310-11 Sponsored by NASA
(NASA-Case-XNP-00644; US-Patent-3,158,764;
US-Patent-Appl-SN-212496) Avail: US Patent Office CSCL 10B

A gas driven jet pump is used to provide high velocity flow of a liquid metal through a magnetic field to generate electrical energy. The liquid metal and gas mixture expands through a nozzle where the liquid metal is immediately separated from the gas and forced to flow as a thin film between two pole pieces, which establishes current flow through the liquid. R.B.

N70-36841*# Naval Ammunition Depot, Crane, Ind.
NASA SPACE CELL TEST PROGRAM Progress Report, Period Ending 15 Aug. 1970
28 Aug. 1970 71 p
(NASA Order S-23404-G)
(NASA-CR-112828; Rept-3022-LAG:bc-8900) Avail: CFSTI CSCL 10C

The test procedures, status, and results are given for the cells, separators, seals, plates, and bellows for various satellites. N.E.N.

N70-36860*# Gulton Industries, Inc., Hawthorne, Calif. Engineered Magnetics Div.
DC POWER SUPPLY ENGINEERED MAGNETICS MODEL EMPS-252 FOR BRAYTON CYCLE POWER CONVERSION SYSTEM Final Report
M. Kruse 27 Aug. 1970 152 p
(Contract NAS3-10936)
(NASA-CR-72529; FR-2390) Avail: CFSTI CSCL 10B

The Brayton dc power supply converts 1200 Hz ac power to positive 28 volt and negative 28 volt dc power for use in the Brayton Space Power System. This supply also includes a positive and a negative 28 volt battery with chargers and control logic that directly supplies dc output power when ac input power is not available for conversion. The measured ac to dc conversion efficiency is 93%. The calculated mean time between failures is approximately 60,000 hours. The theory of operation, electrical and mechanical design drawings, reliability calculations, parts selections, thermal measurements, and test results are presented. Author

N70-36885*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Guidance and Control Div.
SPACECRAFT POWER
In its Space Programs Sum. No. 37-62, Vol. 3 30 Apr. 1970 p 125-148 refs (See N70-36876 20-34)
Copyright. Avail: CFSTI CSCL 10B

The degradation mechanism in the silicon-germanium alloy is discussed, and results are presented for the thermoelectric properties of the 80 at.% silicon-20 at.% germanium alloy. The advantages of radioisotope thermoelectric generators mounted tandomly in the thermoelectric outer planet spacecraft are examined Tests were conducted on sample assemblies of a lightweight integrated silicon solar cell array to accumulate data on thermal stresses and flexural and tensile fatigue effects on solered connectors. Electrode surface reactions were studied, involving the oxidation and reduction of the alkaline silver electrode. The startup of a long term life test of the spare Mariner-Venus 1967 power subsystem is noted. Heat sterilizable battery development; long-life, high cycle life, sealed silver oxide-zinc battery development; and the solar cell standardization program are summarized, along with radiation damage in lithium-doped silicon. J.A.M.

N70-36896*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Propulsion Div.
RESEARCH AND ADVANCED CONCEPTS
In its Space Programs Sum. No. 37-62, Vol. 3 30 Apr. 1970 p 245-271 refs (See N70-36876 20-34)
Copyright. Avail: CFSTI CSCL 10B

A breadboard model of a lightweight, high-efficiency power-conditioning unit with the ability to operate over a range of a two to one variation of input voltage was tested. Malfunctions, including those caused by transient noise, are discussed. Other topics presented include: (1) a 70 kWe thermionic reactor electric propulsion spacecraft, (2) preliminary nuclear criticality studies for a thermionic reactor with uninsulated externally fueled diodes, (3) uranium nitride and tungsten compatibility, and (4) design of reactor simulator for thermionic diode kinetics experiments. F.O.S.

N70-36904*# Hughes Aircraft Co., El Segundo, Calif. Space Systems Div.
STUDY ON INTEGRATION OF SILVER-ZINC BATTERY IMPROVEMENTS Interim Technical Report, 1 Jan. – 30 Jun. 1970
R. J. Haas and R. A. Steinhauer 30 Jun. 1970 63 p
(Contract NAS5-11579)
(NASA-CR-112681; SSD-0034OR; Rept-70(22)-3276/B6700; ITR-4) Avail: CFSTI CSCL 10C

Technical progress and status of a program to develop an advanced single cell design for incorporation into a 12-amp-hr five-cell, sealed silver-zinc battery. During this reporting period the component and single cell design was developed for the five-cell battery. Author

N70-36928*# TRW Systems Group, Redondo Beach, Calif.
CHARGED PARTICLE RADIATION DAMAGE IN SEMICONDUCTORS, 15: STUDY AND DETERMINATION OF AN OPTIMUM DESIGN FOR SPACE UTILIZED LITHIUM DOPED SOLAR CELLS, PART 1 Interim Final Report
R. G. Downing, J. R. Carter, R. E. Scott, and W. K. Van Atta 19 Jun. 1970 95 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952554)
(NASA-CR-112867; TRW-13154-6011-R0-00-Pt-1) Avail: CFSTI CSCL 10B

Hall coefficient measurements were made on lithium-doped silicon having dopant concentrations comparable to those found in solar cells. The results of the measurements of these materials indicate that two defect complexes are formed during irradiation. The E sub c -0.17 eV acceptor (oxygen-vacancy pair) is one of these defects. The other defect is associated with a deeper lying energy level which may be a lithium-vacancy pair; this level is found only in float-zone silicon. Capacitance measurements on irradiated lithium-doped solar cells were made as a function of voltage and frequency. This work indicates that irradiation of quartz crucible silicon solar cells results primarily in the formation of E sub c-0.17 eV acceptor defects. These defects are later annihilated by reaction with lithium donors. Lithium compensated p-type silicon was irradiated and the electrical measurements suggest that lithium reacts with radiation defects in a manner which may provide a hardening effect on n/p solar cells. A study was performed to evaluate the effectiveness of bismuth and tin doping to achieve radiation hardness with negative results. Author

N70-36940*# Boeing Co., Seattle, Wash. Space Div.
LIGHT WEIGHT SOLAR PANEL DEVELOPMENT Final Report
J. A. Lackey, E. L. Leppert, H. M. Mc Daniel, and D. A. Norsen Jul. 1970 198 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952571)
(NASA-CR-112869; D2-121773-2) Avail: CFSTI CSCL 10B

Preliminary design, analysis, test article design, fabrication, and test of a light weight solar panel made of built-up beryllium structure, and with 28 square feet of active cell area are described. The test article, how the tests were performed, and the results of the modal survey, reverberant acoustic, random vibration, sinusoidal vibration, static load, thermal-vacuum-shock, substrate frequency check, and power output tests are also examined. Author

N70-36944*# Tyco Labs., Inc., Waltham, Mass.
ALUMINUM CHLORINE BATTERY Final Technical Report, 27 May 1968 – 26 Mar. 1970
Jose Giner and Gerhard L. Holleck Jun. 1970 78 p refs
(Contract NAS12-688)
(NASA-CR-112682) Avail: CFSTI CSCL 10C

A molten salt system based on Al- and Cl2-carbon electrodes, with an AlCl3-alkali chloride eutectic as electrolyte, was investigated as a rechargeable, high energy density battery which can operate at a relatively low temperature and may withstand sterilization. To obtain pure AlCl3-KCl-NaCl melts, different commercial AlCl3 materials were investigaged. FeCl3 was found to be the major impurity in all of them. A procedure involving treatment of a melt of high AlCl3 concentration with magnesium powder or with in-situ generated, finely divided Al prior to evaporation yielded pure AlCl3. AlCl3-KCl-NaCl melts using this material stay clear (nearly colorless) and show practically no background current. Author

N70-36957# Lockheed Missiles and Space Co., Palto Alto, Calif.
ANALYSIS OF THROTTLED CLOSED CRYOGENIC SYSTEM OPERATION IN THE UNRATED MODES
V. N. Novotelnov et al 1970 3 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Energ. (USSR), No. 5, 1970 p 126 – 127
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Operating principles of a microcryogenic throttled system operating in a closed cycle are analyzed for the +60 to -60 C range. The heaviest mode corresponds to the maximum temperature +60 C of the surrounding medium. It is assumed that heat influx from the cooled object, as well as low pressure in the system, remain constant. The design analysis shows that the energy efficiency diminishes for an unregulated system as the temperature of the ambient medium is lowered while the required power increases correspondingly. Insertion of regulation into the system increases its efficiency substantially. G.G.

N70-36996# Addis Translations International, Woodside, Calif.
RADIONUCLIDE BATTERIES [RADIONUKLIDBATTERIEN]
K. J. Euler et al Mar. 1970 38 p refs Transl. into ENGLISH from Elektrotech. Maschinenbau (Berlin), v. 86, no. 11, Nov. 1969 p 463 – 472 Prepared for Calif. Univ., Lawrence Radiation Lab.
(UCRL-Trans-10463) Avail: CFSTI

Conversion methods and uses of radionuclide batteries are discussed. The conversion methods include: thermoelectric, thermionic, photoelectric, and dynamoelectric. The uses discussed include navigation at sea, navigation in air, meteorology, oceanography, telecommunications, cathode corrosion protection, and medicine. NSA

N70-37465*# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
STUDY OF FABRICATION TECHNIQUES FOR SiC SOLAR CELLS Final Technical Report
R. B. Campbell and H. S. Berman Jul. 1970 78 p refs
(Contract NAS2-5595)
(NASA-CR-73444; WANL-PR-TTT-001) Avail: CFSTI CSCL 10B

Silicon carbide unijunction diodes were investigated for use as possible solar cells. The devices can be used in this manner, although the overall conversion efficiency of solar energy into electrical energy is much lower than Si diodes. This lower efficiency is due mainly to fewer photons of proper energy available for conversion, reflection losses, and poor collection efficiency in the SiC diode. Both grown and diffused junctions were investigated. A graded junction structure with a junction depth of 15 microns was determined to be optimum. Techniques for applying gridded contacts were developed. The single junction cells exhibited maximum power at 250 C although they were operable at reduced efficiency to 400 C and would survive temperatures to 1000 C without

damage. The cells operated satisfactorily when connected in series and parallel configurations. Several other cell structures such as the multiple junction and multiple transition were investigated. These structures show a greatly increased efficiency over the single junction cell. Author

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N70-36211# Mount Sinai Hospital, New York. Dept. of Pathology.

HEPATIC SUBCELLULAR EFFECTS OF ALTERED ATMOSPHERES Final Report, Dec. 1965 – Nov. 1967

Fenton Schaffner and Franklin M. Klion Nov. 1969 22 p refs
(Contract AF 33(615)-3464)
(AD-705220; AMRL-TR-67-231) Avail: CFSTI CSCL 6/19

Liver tissues of rats, dogs and monkeys were examined electron microscopically after exposure to pure oxygen at pressures varying from 258-2280 mm Hg for periods of time from 15 minutes to 8 months. Results of these were compared in many instances with similar tissue from animals exposed to two-gas atmospheres. The studies indicate that mitochondria in liver cells are altered, but that adaptation to the altered atmosphere occurs. Adaptation in the liver is complete with no evidence of damage. Author (TAB)

N70-36232# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

QUANTITATIVE CONTENT OF MICROORGANISMS IN HIGH ATMOSPHERIC LAYERS

Ya. G. Kishko 26 Feb. 1970 12 p refs Transl. into ENGLISH from Mikrobiol. Zh., Akad. Nauk Ukr. RSR (Kiev), v. 22, no. 6, 1960 p 77–81
(AD-703889; FTD-HT-23-24-70) Avail: CFSTI CSCL 6/13

From May to September 1957 bacteriological investigations of high altitude air in a vertical section were conducted. Air samples were collected by mounting in the window of an LI-2 sounding aircraft a collector in which a Petri dish with a nutrient medium was placed during the investigations. Twenty-five flights were made under various meteorological conditions. As the results of investigations showed most inseminated with microorganisms was the air layer ajoining the earth up to 500 m (846-624 colonies in 1 m(superscript 3) of air). With altitude the quantity of microorganisms decreased at an altitude of 3000 m by eight times, at an altitude of 7000 m by more than 100 times. It was also noticed that under the conditions of the high layers of the atmosphere there exists a definite relationship in the content of microorganisms with the humidity of the air- the dryer the air, the less microorganisms are in it. Clouds, as observations have shown, contained a greater amount of microorganisms. If the content of microorganisms in a cloud level for 264 colonies in 1 m(superscript 3) of air is taken as the standard at 100 percent, then in clouds it was equal to 215.1 percent and above the clouds only 53.7 percent. Author (TAB)

N70-36249# Aerospace Medical Div. Aeromedical Research Lab. (6571st), Holloman AFB, N.Mex.

MEASUREMENT OF HEAD ANGULAR ACCELERATION DURING IMPACT

Charles D. Bendixen Mar. 1970 18 p refs
(AD-704704; ARL-TR-70-5) Avail: CFSTI CSCL 6/19

The incidence of cerebral concussion incurred during impact conditions has been shown to be related to the levels of angular acceleration which a head undergoes during impact. Also, since the forces causing angular acceleration of the head during impact are transmitted by neck structures, measurement of head angular accelerations may give a good indication of neck injury potential in various impact situations. Studies relating these injuries to head angular acceleration values have been hampered in the past by the lack of an accurate technique for measuring angular acceleration. We have developed a system employing linear accelerometers mounted on the subjects head and oriented in such a manner that the tangential acceleration of one point on the head is found relative to another point and subsequently angular acceleration is determined. This system has shown improved accuracy in angular acceleration measurement over previously used methods and should aid in the study of head and neck injuries during impact. Author (TAB)

N70-36272# Hull Univ. (England). Dept. of Biochemistry.

THE ENDOGENOUS METABOLISM OF ANAEROBIC BACTERIA Final Technical Report, May 1968 – Sep. 1969

E. A. Dawes, P. J. Large, J. Baxon, J. G. Morton, and S. Murden Dec. 1969 30 p refs
(Contract DAJA37-67-C-0567)
(AD-703930) Avail: CFSTI CSCL 6/13

Studies of the endogenous metabolism and survival of the non-spore-forming anaerobic bacteria Zymomonas anaerobia and Peptococcus prevotii under conditions of starvation have been continued. The nutritional requirements of Z. anaerobia have been further delineated in order that the organism might be grown under defined conditions. Response curves for biotin and lipoic acid, shown to be essential for growth, revealed that their action is not additive and that together they are not so effective as a mixture containing nine additional vitamins. A detailed survey of the amino acid requirements showed that the organism is more exacting than the related Zymomonas mobilis and growth on ammonium salts is very poor. The ATP content of P. prevotii during growth has been studied and the effect of washing cells prior to analysis examined. The ability to ferment serine during prolonged starvation was gradually lost over a period of 48 hrs, correlating with previously observed response of ATP production to pulses of serine. Extracts of P. prevotii contain acetate kinase and phosphotransacetylase and these enzymes have been studied. Author (TAB)

N70-36291# Gesellschaft fuer Strahlenforschung m.b.H., Munich (West Germany). Inst. fuer Biologie.

PATHOGENESIS OF GENETIC AND SOMATIC RADIATION DAMAGE Final Annual Report, 1965-1967 [PATHOGENESE GENETISCHER UND SOMATISCHER STRAHLENSCHAE - DEN. ABSCHLUSSBERICHT UEBER DIE WISSENSCHAFTLICHE TAETIGKEIT IN DEN JAHREN 1965-1967 (ZUGLEICH JAHRESBERICHT 1967)]

Luxemburg, EURATOM Apr. 1970 22 p In GERMAN; ENGLISH summary *Its* Assoc. No. 045-65-1 BIAD
(EUR-4405.d) Avail: CFSTI

Experimental studies on the frequency and origin of somatic and genetic radiation damage from irradiation administered externally or after incorporation of radioactive nuclides are reported. The research covers selected problems in the radiation genetics of vertebrates, neurophysiological studies and behavioral studies, and radiotoxicity. Author

N70-36301# Naval Air Development Center, Johnsville, Pa. Aerospace Medical Research Dept.

RENAL HEMODYNAMIC RESPONSE OF UNANESTHETIZED DOGS TO NEGATIVE ACCELERATION

John E. Chimoskey 2 Mar. 1970 25 p refs
(AD-702745; NADC-MR-7002) Avail: CFSTI CSCL 6/19

Trained unanesthetized dogs were exposed to negative centrifugal accelerations up to -3Gz. Renal arterial pressure and inferior vena cava pressure at kidney level were measured through indwelling catheters. Renal blood flow velocity was measured by a Doppler flow meter. The flow signal was telemetered and the pressure signals were transferred by slip rings from the centrifuge. About 10 days after the sensing devices were implanted under pentobarbital anesthesia, the experiments began for which the dogs were unanesthetized. Renal blood flow velocity decreased in proportion to the magnitude of -Gz. The minimum flow velocity was significantly lower during -3Gz than it was during -1 and -2Gz. By the end of the 27 to 30 second periods of constant -Gz, flow velocity recovered significantly from the minimum values. The lowest mean arterial-venous pressure gradient, 129 plus or minus 7 (S.E.) mm Hg, recorded during -3Gz, did not differ significantly from the mean preacceleration value. Calculated intrarenal resistance to blood flow increased. Flow velocity reductions on a given day were frequently smaller after the first acceleration. Author (TAB)

N70-36394# Eidgenossische Technische Hochschule, Zurich (Switzerland).

THE IMPORTANCE OF TOPOLOGICAL CHARACTERISTICS FOR THE STEREOSCOPIC RECOGNITION OF ACCIDENTAL PATTERNS [DIE BEDEUTUNG TOPOLOGISCHER CHARAKTERISTIKA BEI DER STEREOSKOPISCHEN WAHRNEHMUNG VON ZUFALLSMUSTERN]

Hans Rudolf Moning (Ph.D. Thesis) Goettingen, W. Germany 1969 42 p refs In GERMAN; ENGLISH summary
(DISS-4259) Avail: CFSTI

Random-dot stereo images of white and black picture elements (generated by computer) were presented to the subjects in a stereotachistoscope (exposure time: 200 ms) in order to study quality of stereopsis as a function of the frequency of white elements. The results suggest that the quality of stereopsis under tachistoscopic conditions is influenced by topological properties of the random-dot patterns (varying with the frequency of white elements) concerning cluster formation (connectivity of adjacent elements). These properties are different from the common notion texture abundance that reaches the maximum at 50% white picture-elements. Author

N70-36397# Wake Forest Coll., Winston-Salem, N.C. Bowman Gray School of Medicine.

EVALUATION OF CEREBRAL AND SYMMETRIC VASCULAR DYNAMICS IN RESPONSE TO STRESS Annual Summary Report

Henry S. Miller, Jr. 1 May 1969 9 p
(Contract DA-49-193-MD-2794)
(AD-701941) Avail: CFSTI CSCL 6/19

The project was instituted to investigate the vascular dynamics under stress conditions. Transducer techniques were developed for obtaining direct and indirect measurements of the physiological variables under investigation and mathematical techniques for the computer analysis of this data. A 6 Channel recorder was modified for 6 Channel electrocardiogram recording at rest and during active exercise. Atrial pacing, treadmill exercise and drug injections have been used as methods of stressing the cardiovascular system. The electrocardiogram, apexcardiogram, carotid pulse waves, phonocardiography and blood pressure have been done before and after exercise. In patients with known coronary artery disease, intra-arterial pressures, electrocardiogram, and clinical evidence of cerebral and coronary insufficiency are recorded during the stress by rapid atrial pacing. Two groups of 20 subjects have undergone 20 weeks of exercise for physical conditioning, exercising 1 hour four days a week at 60-70% of maximum pre and post training. Treadmill stress and electrocardiogram, O sub 2 consumption and numerous chemistries were recorded. Physical conditioning increased tolerance, maximum oxygen consumption and recovery rate based on the return of pulse rate to normal. Author (TAB)

N70-36418# Pittsburgh Univ., Pa.

EFFECTS OF HEAT STRESS ON CELLULAR STRUCTURE AND FUNCTION Technical Report, Jan. 1966 – Dec. 1969

Ralph Buchsbaum, Jack Perchersky, and David Mc Kibben Wright-Patterson AFB, Ohio AMRL Feb. 1970 22 p refs
(Contract AF 33(615)-3375)
(AD-705654; AMRL-TR-70-1) Avail: CFSTI CSCL 6/19

The report demonstrates the effects of heat stress on kidney and liver tissues. It has been found that kidneys stressed to temperatures in excess of 41C undergo progressive damage. Observations utilizing the electron microscope show degenerative effects on cell organelles, especially mitochondria. Whole animals (CF-1 mice) heated in ambient temperatures of 40C to 45C for 30 minutes were used to determine the level at which 50% will survive. This ambient temperature was found to be 42C (LD50). The liver of animals subjected to 43C rectal temperature for varying lengths of time demonstrate various levels of cellular degeneration. Mitochondrial swelling and degeneration, the formation of large lipid droplets and loss of glycogen are typical of heat stressed liver cells. The mitotic index was determined using tritium labelled thymidine. Mitosis is suppressed for a period of 8 to 24 hours after heat-stress near the LD50 temperature, increases to more than twice the control value, and then returns to normal within 3 to 4 days. Author (TAB)

N70-36431# Weizmann Inst. of Science, Rehovoth (Israel). Polymer Dept.

PHYSICAL CHARACTERISTICS OF SYNTHETIC AND NERVE MEMBRANES Final Report, 1 Nov. 1966 – 31 Dec. 1968

Aharon Katchalsky and Israel R. Miller Jul. 1969 47 p refs
(Contract F61052-67-C-0031)
(AD-698816; AFOSR-69-3085TR) Avail: CFSTI CSCL 7/4

The research on this project was carried out along two closely related lines: One line of investigation was devoted to the theoretical analysis of transport processes across membranes using nonequilibrium thermodynamics. In the framework of this project chemicodiffusional coupling was considered and applied to facilitated or carrier transport. The second line of investigation was essentially experimental in approach. (a) In an attempt to construct a well defined model for very thin biological membranes, the kinetic coefficients for ion permeability through monolayers were determined. The monolayers were adsorbed at the interface between a mercury electrode and water, and the ionic permeability measured polarographically. By this method the transport of Cu(++) across a decylammonium monolayer and its dependence on temperature was investigated. (B) The transport of ions across a composite double membrane was measured as a function of the applied potential. In a membrane composed of cation and anion exchange elements in series, the ionic distribution was studied, and the results analyzed by the methods of nonequilibrium thermodynamics. Author (TAB)

N70-36435# School of Aerospace Medicine, Brooks AFB, Tex.

AN ADJUSTABLE HEADHOLDER FOR CALORIC TESTING OF SEMICIRCULAR CANAL FUNCTION Final Report, May – Jul. 1969

J. W. Wolfe and J. L. Bower Oct. 1969 11 p
(AD-700738; SAM-TR-69-71) Avail: CFSTI CSCL 6/12

A device is described for orienting the head of the patient during caloric examination of vestibular nystagmus. The headholder consists of a hinged wedge of plywood with adjustable head clamps which provide adequate but painless restraint of the head. Kidney-shaped basins, shaped to fit snugly under the ear, catch surplus water from each ear. Whereas data collected from 10 subjects using the standard clinical method of pillow support were highly variable between and within subjects, data obtained from 12 normal subjects using the headholder reflected a reduction in variance and a more symmetrical distribution across conditions. Author (TAB)

N70-38449# Human Resources Research Organization, Alexandria, Va.
HUM RRO STUDIES IN CONTINUOUS OPERATIONS
Donald F. Haggard Mar. 1970 15 p refs Presented at the 15th Ann. Army Human Factors Res. and Develop. Conf., Fort Ord, Calif., Nov. 1969 *Its* HumRRO Professional Paper No. 7-70
(Contract DAHC19-70-C-0012)
(AD-705705) Avail: CFSTI CSCL 5/5

A laboratory study and a field study were conducted to obtain data on performance decrements on tank crew tasks during 48 hours of continuous combat operations, and to examine the degree of decrement in terms of its effect on tactical efficiency. Experience in the studies illustrates the need for increased efficiency in obtaining human factors information, demanded by the increasing complexity of military tactics and equipment. Author (TAB)

N70-38468# School of Aerospace Medicine, Brooks AFB, Tex. Pharmacology-Biochemistry Branch.
EFFECTS OF NITROGEN TRIFLUORIDE ON CARDIOVASCULAR SYSTEM OF RATS
Lloyd L. Foster Feb. 1970 13 p refs
(AD-705045; SAM-TR-70-8) Avail: CFSTI CSCL 6/20

Rats were exposed for 1 minute to tracheal inhalation of nitrogen trifluoride (NF3) gas to determine its toxic effects upon the cardiovascular system. These rats had a definite decrease in diastolic pressure, systolic pressure, and heart rate. Similarly, rats that prebreathed oxygen for 5 minutes before exposure had the same changes in the cardiovascular system as those breathing only NF3. However, animals which inhaled oxygen for 5 minutes immediately after exposure to NF3 showed a temporary increase in diastolic pressure, systolic pressure, and heart rate. Author (TAB)

N70-38473*# Microbiological Associates, Inc., Bethesda, Md.
STUDY OF THE MURINE VIRUSES PRESENT IN 'GERMFREE' MICE Final Report, 1 Sep. 1968 – 30 Jun. 1970
John C. Parker 30 Jun. 1970 16 p
(Contract NAS9-8641)
(NASA-CR-108589) Avail: CFSTI CSCL 06M

The NASA germfree mouse colony was established and monitored for indigenous virus infection. Starting with a breeding nucleus and continuing through P sub 3 generation to the expansion colony, no evidence was found for infection with the following viruses: pneumonia virus of mice, mouse pneumonitis, polyoma, Sendai, minute virus of mice, ectromelia, mouse adenovirus, mouse hepatitis, lymphocytic chriomeningitis, Riley, mouse salivary gland virus, thymic or epidemic diarrhea of infant mice. Some equivocal data were obtained with regard to reovirus type 3, and Theiler's encephalomyelitis virus infection, however, it is likely that the mice are not infected with either of these agents. There is infection throughout the colony with mouse leukemia virus. A virus profile analysis was performed on two groups of 150 germfree mice, each taken from a sample of 750 germfree mice used in the Apollo 11 and Apollo 12 missions. Author

N70-38495# Naval Aerospace Medical Inst., Pensacola, Fla.
ANTHROPOMETRIC DETERMINATIONS OF AMERICAN BORN MACACA MULATTA
Keith A. Clark and Albert E. New 16 Jul. 1969 43 p refs
(AD-700907; NAMI-1078) Avail: CFSTI CSCL 6/3

Knowledge of anthropometric parameters of a group of American born Macaca mulatta became necessary for hardware design in the course of an orbiting primate experiment. The values obtained for 35 anthropometric parameters on 23 immature laboratory-born monkeys are presented. These parameters are classified according to age and sex of the animals and graded as to their reliability and reproducibility. The data can serve as baselines for extensive body measurements of the American born rhesus monkeys and can be useful any time these monkeys are used in experimental procedures. Author (TAB)

N70-38546# Hawaii Univ., Honolulu. Dept. of Microbiology.
OCEAN PHOTOSYNTHESIS. EFFECTS OF HYDROSTATIC PRESSURE ON PHOTOSYNTHESIS AND GROWTH OF UNICELLULAR MARINE ALGAE AND DIATOMS Annual Progress Report
Leslie R. Berger, Leslie Q. Tam, and Danny H. Pope 1 Apr. 1970 14 p refs
(Contract N00014-67-A-0387-0008)
(AD-704496; APR-1) Avail: CFSTI CSCL 8/1

Photosynthesis, measured as light-dependent evolution of oxygen was demonstrated in both green and blue-green algae species at hydrostatic pressures exceeding 600 atmospheres. The methodology which made these observations possible is described. A technique to grow obligately aerobic organisms at increased pressures to high population densities is also described. Author (TAB)

N70-38551# Naval Medical Research Inst., Bethesda, Md.
THE PERSONALITY CORRELATES OF THE CENTERING OF "SELF" IN THE PHENOMENAL FIELD Interim Report
Philip Briley Apr. 1970 35 p refs
(AD-705085; MF12.524-003-1005D; Rept-4) Avail: CFSTI CSCL 5/10

The study was designed to explore the relationship between the centrality-of-self in the phenomenal field, as it is symbolically represented and three personality dimensions: personal adjustment, self-confidence, and defensiveness. A two-group repeated measures study was done using United States Navy enlisted men of comparable intelligence, education, age, and marital status. A centrality-of-self score, the distance between the center of the field and the center of the self circle in millimeters, and a Z score on each of the three personality scales were determined for each of the fifty-nine subjects. An analysis of the results indicates that there is sufficient evidence for some support for the first experimental hypothesis, but not the second and third. Some of the reasons for this lack of confirmation were discussed. Author (TAB)

N70-38574# Naval Medical Research Inst., Bethesda, Md.
PROJECT RIM: OBSERVATIONAL DATA COLLECTION Interim Report
Ira Donenfeld, Seward Smith, William W. Haythorn, John M. Libert, and Martin A. Brown Apr. 1970 28 p refs
(AD-705066; NAVMED-MF12.524-003-1005D) Avail: CFSTI CSCL 5/10

The purpose of the report is to describe the methodology developed on Project RIM to collect a large and systematic body of observational data for small groups confined for 21-day periods. The data collection was accomplished by two techniques: (a) a comprehensive behavior log systematically gathered by trained observers, and (b) the automated recording of video samples. The introductory section includes a brief description of Project RIM and details of the rationale for collecting subtle indices of social-psychological functioning. In subsequent sections, attention is focused on the behavior-log and video-sample observational techniques, a description of the data collected, and a description of the behavioral measures derived from the data collected, such as alone vs. together activity, and body and eye orientation. Author (TAB)

N70-38575# Naval Medical Research Inst., Bethesda, Md.
BIBLIOGRAPHY ON SAFE HUMAN THRESHOLDS TO EXTRA-LOW-FREQUENCY ELECTRIC CURRENT
John C. Keesey Mar. 1970 48 p
(AD-705067; NAVMED-MR005.08-0030B-2) Avail: CFSTI CSCL 6/16

Over one thousand references on electric shock hazards and electrical safety are included from three computer retrievals, a sixty-hour Library of Congress search and contributions from over 50 organizations and individuals. The citations are divided into sections according to subject matter and arranged alphabetically by author within each section. Emphasis is upon published original experimental work concerning physiological thresholds to electric current at power transmission frequencies. Experimental work on biological impedances and on the pathophysiology of electric shock is also represented extensively. Clinical reports of pathological sequelae of electric shock are categorized, as are electrical safety standards in industry, agriculture and medicine. A few biological references obtained on peripherally-related subjects such as electroanesthesia, electroconvulsive therapy and legal execution are included. Finally, selected general reviews are presented. Author (TAB)

N70-36764*# West Virginia Univ., Morgantown.
THE EFFECT OF CHANGING GRAVITY AND WEIGHTLESSNESS ON VASOPRESSIN CONTROL SYSTEMS Progress Report, 21 Oct. 1969 - 15 Feb. 1970
Walter H. Moran, Jr. 15 Feb. 1970 7 p refs
(Grant NGR-49-001-019)
(NASA-CR-112358) Avail: CFSTI CSCL 06S

Using the LAP6/WVU system, a comparative study of the immunochemical and antidiuretic biological assays of vasopressin is reported. The first step in the study consisted of calibrating the reference standards. Secondly, calculated amounts of master reference standard were added to fresh plasma prior to extraction; the amounts of added vasopressin were calculated to fall within an easily detectable range. The procedure used and the results for bioassay and immunoassay are given. A semiqualitative comparison was made and is reported. The immunochemical activity matched the biological activity of vasopressin, although a lack of adequate sensitivity of the immunoassay was observed. Immunochemical assay was then experimentally used for the estimation of vasopressin content of rat urine. P.A.B.

N70-36813*# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
WEIGHT, VOLUME, AND CENTER OF MASS OF SEGMENTS OF THE HUMAN BODY
Charles E. Clauser, John T. McConville (Antioch Coll.), and J. W. Young (Civil Aeromedical Inst.) Aug. 1969 108 p refs
(NASA Order R-90)
(NASA-CR-112672; AMRL-TR-69-70) Avail: CFSTI CSCL 06P

The study was designed to supplement existing knowledge of the weight, volume, and center of mass of segments of the human body and to permit their more accurate estimation on the living from anthropometric dimensions. Weight, volume, and center of mass of 14 segments of the body were determined on 13 male cadavers. Descriptive statistics are presented of these variables as well as a series of regression equations predicting these parameters from anthropometry. Reports of studies are included of the mid-volume of segments as an approximation of their center of mass, relationships between standing and supine anthropometry, postmortem changes in gross body size, and comparisons between densities of fresh and preserved human tissues. Author

N70-36820*# Oak Ridge National Lab., Tenn. Biology Div.
NEUROSPORA EXPERIMENT P-1037 Final Report
Frederick J. de Serres Mar. 1970 24 p refs Sponsored in part by NASA and AEC
(NASA-CR-112355 ORNL-TM-2912) Avail: CFSTI CSCL 06R

Genetic effects of space flight alone in combination with known doses of radiation on Neurospora were investigated during Gemini 11 and Biosatellite 2 missions. On the Biosatellite 2 mission a Sr-85 gamma ray source was used; on the Gemini 11 mission a P-32 beta ray source was used. Comparisons were made between flight and ground-control dose response curves. In the Biosatellite 2 experiment *Neurospora* conidia were tested while collected on the surface of Millipore filters; in the Gemini 11 experiment they were tested both while collected on the surface of Millipore filters and while in a colloidal suspension of agar. The data from the Biosatellite 2 experiments show that there was no difference between the flight and ground-control survival curves nor between flight and ground-control curves for the overall induction of ad-3 mutations. The data from the Gemini 11 experiments show that the samples were affected in the same way. Data from samples flown in suspension showed higher levels of survival and lower frequencies of mutation induction. NSA

N70-36857*# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
NONLINEAR ANALYSIS OF PRESSURE AND SHOCK WAVES IN BLOOD VESSELS
Robert L. Rockwell (Ph.D. Thesis) Dec. 1969 122 p refs
(Grant NGL-05-020-223)
(NASA-CR-112864; SUDAAR-394) Avail: CFSTI CSCL 06C

A nonlinear analysis of large amplitude pressure waves was made for a theoretical model of the canine aorta and its continuation beyond the saphenous artery. In particular the changes in the pressure and flow pulses produced by the heart were assessed for meaningful variations in the system parameters. To allow for the interpretation of relatively small changes in the pressure and flow patterns it was considered necessary to take nonlinearities into account as accurately as possible. According to recent experimental evidence, the propagation of the natural pressure pulse should be strongly affected by nonlinear phenomena such as the wave speed variations with pressure and flow and the large local changes in cross-sectional area with pressure. Pressure and flow pulses induced in the aorta and other large arteries were predicted by prescribing the ejection pattern of the heart and the physical and geometric features of the system. The effects of branches and bifurcations were modeled by a continuous outflow pattern which varies with location and pressure. The basic geometry was defined by an exponential decrease of the cross-sectional area of the artery with distance from the heart. Author

N70-36993# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
THE ASSESSMENT OF BONE MARROW INTERNAL EXPOSURE TO STRONTIUM 90 AS A FUNCTION OF AGE [EVALUATION DE L'IRRADIATION DE LA MOELLE OSSEUSE EN FONCTION DE L'AGE APRES CONTAMINATION PAR LE STRONTIUM 90]
Monique Odievre and David Mechali Feb. 1970 34 p refs In FRENCH; ENGLISH summary
(CEA-R-3952) Avail: CFSTI

Bone marrow exposure is considered as being representative of the hazards following contamination by Sr-90. The general method of assessing the exposure and the evolution of the values of the different parameters used as functions of age are described. Exposure following ingestion and via the respiratory route were studied successively. In each case continuous and short-time exposures were used. In the former the time evolution of dose rates as a function of the age at the beginning of the exposure were measured while in the latter it was analyzed as a function of the doses used. Author (ESRO)

N70-36998# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
ELECTRON SPIN RESONANCE STUDY OF FREE RADICALS CREATED BY RADIATIONS IN SOME ORGANIC SUBSTANCES: APPLICATION TO DOSIMETRY MEASUREMENT OF FREE RADICALS PRODUCED IN

ALANINE [ETUDE PAR RPE DES RADICAUX LIBRES CREES SOUS IRRADIATION DANS CERTAINES SUBSTANCES ORGANIQUES: APPLICATION EN DOSIMETRIE DE LA MESURE DES RADICAUX LIBRES CREES DANS L'ALANINE]

Solange Descours, Jacques Assayrenc, Francis Bermann, Bernard Couderc, Henri de Choudens et al May 1970 47 p refs In FRENCH; ENGLISH summary
(CEA-R-3913) Avail: CFSTI

This report completes the results obtained with free radicals created in glycine. The nature and number of these radicals produced by irradiation in cysteine and glutathione were investigated, and free radicals generated in alanine were specially studied. A linear law holds over a large dose range between the number of radicals created and the absorbed dose and this property along with the high stability of the radicals makes this amino acid of use in the dosimetry field. With 1 g alanine powder, it was possible to make gamma ray measurements between 5 and 5 million rads. The radical yield was lower for neutrons than for gamma rays. A larger yield was obtained by adding paraffin and it was possible to make compact dosimeters which were easier to use than alanine powder ones. Addition of a higher Z constituent e.g. Ca, Ba, might improve the yield of the dosimeter for gamma rays with energy less than 70 keV. Author (ESRO)

N70-37015# Commissariat a l'Energie Atomique, Grenoble (France). Centres d'Etudes Nucleaires.

DETECTION OF RARE-EARTHS IN PLANTS USING RADIOACTIVATION METHODS: APPLICATION OF THE METHOD IN GEOCHEMICAL ECOLOGY [LA RECHERCHE DES TERRES RARES DANS LES VEGETAUX AU MOYEN DE L'ANALYSE PAR RADIOACTIVATION; POSSIBILITES DE LA METHODE EN ECOLOGIE GEOCHIMIQUE]

Robert Danne and Andre Fourcy Jan. 1970 25 p refs In FRENCH; ENGLISH summary
(CEA-R-3917) Avail: CFSTI

A method for the quantitative analysis of the rare earth elements in plant material was designed. Ashed plant material was irradiated for 96 hours by a 2 x 10 to the 13th power neutrons/(sq cm)(sec) thermal flux in a swimming pool type reactor. The rare earth group was isolated by precipitation with liquid ammonia and radiochemically purified by a first sequential chromatography on a cationic resin. Rare earth elements were separated from one another by a second chromatography on a cationic resin according to the alpha-hydroxyisobutyric acid process. The different elements were analysed by gamma spectrometry by comparison with an identically activated standard. The method permits accurate analysis of 11 lanthanides, some of which exist in amounts lower than the ppm range. Walnut leaves (Juglans nigra) and aerial organs of Cladium mariscus and the corresponding peaty soil were analysed. The absolute levels of the rare earth elements differed between samples but their relative distributions were almost the same. Author (ESRO)

N70-37029*# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.

EXPERIMENTAL STUDIES OF THE VARIATIONS IN THE MECHANICAL PROPERTIES OF THE CANINE ABDOMINAL VENA CAVA

William G. Yates (Ph.D. Thesis) Nov. 1969 118 p refs
(Grant NGR-05-020-223)
(NASA-CR-112876; SUDAAR-393) Avail: CFSTI CSCL 06C

A study was conducted to acquire quantitative data which will aid the development of a mathematical model for the mechanical behavior of large veins, including the associated control mechanisms. A method for determining the speed and attenuation of artificially induced pressure waves propagating in the abdominal vena cava of anesthetized dogs is described. Short trains of small-amplitude, sinusoidal pressure waves are generated by a vibrating piston placed in the left common iliac vein. The volumetric displacements generated by the piston movement create small pressure waves which propagate into the vena cava. The amplitude and frequency of the piston movement can be accurately controlled. Two catheter-tip manometers, which are placed a few centimeters apart in the segment of abdominal vena cava between the bifurcation and the renal branches, detect the propagating pressure waves; the outputs from the manometers are amplified and recorded on a high-speed oscillograph. The wave speed is calculated by dividing the distance between the catheter-tip manometers by the time required for a particular wave to travel from one manometer to the other. The attenuation is obtained by comparing the wave amplitudes recorded by the two transducers. Author

N70-37047# Sheffield Univ. (England).

INTESTINAL ABSORPTION INFORMATION CENTRE Progress Report, Sep. 1968 - Mar. 1969

[1969] 25 p
(OSTI-5027) Avail: CFSTI

The report describes the development of an intestinal absorption information service. A case history of the project is presented and an investigation of computer-based current awareness services (ASCA, MEDLARS, CBAC, and CT) is described. A list of projects for future investigation is also given. ESRO

N70-37063# Joint Publications Research Service, Washington, D.C.

EFFECTS OF STRESS AND OTHER CONDITIONS ON HIGHER NERVOUS ACTIVITY

I. S. Dobrovravova et al 31 Jul. 1970 11 p refs Transl. into ENGLISH from Zh. Vysshei Nervnoi Deyatelnosti (Moscow), v. 20, no. 3, May - Jun. 1970 p 647 - 649 and 655 - 657
(JPRS-51067) Avail: CFSTI

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2. RHEOENCEPHALOGRAPHY AS AN INTEGRAL METHOD OF REGISTRATION OF PSYCHIC STRESS V. N. Pushkin et al p 5 - 9 refs (See N70-37065 20-04)

N70-37064# Joint Publications Research Service, Washington, D.C.

CHANGES IN SOME ELECTROPHYSIOLOGICAL PARAMETERS AFTER DISTURBANCE OF A RHYTHMIC SYSTEM OF MOTOR-CONDITIONED REACTIONS IN MAN

I. S. Dobronravova *In its* Effects of Stress and Other Conditions on Higher Nervous Activity 31 Jul. 1970 p 1 - 4 refs (See N70-37063 20-04)
Avail: CFSTI

Investigated are changes in EEG and EMG in humans following disturbance of the stability of the rhythmic system of motor conditioned reactions. A clear dependence of the degree of disturbance on the moment in the time interval between rhythmic subsequent conditioned stimuli at which the unexpected signal was presented, was established. Obtained data indicate that larger disturbances of the system require prolonged generalized excitation of the central nervous system which involves the non-specific structure and its higher level. G.G.

N70-37065# Joint Publications Research Service, Washington, D.C.

RHEOENCEPHALOGRAPHY AS AN INTEGRAL METHOD OF REGISTRATION OF PSYCHIC STRESS

V. N. Pushkin et al *In its* Effects of Stress and Other Conditions on Higher Nervous Activity 31 Jul. 1970 p 5 - 9 refs (See

N70-37063 20-04)
Avail: CFSTI

The use of REG in the clinic provided accurate information about the intensity the cerebral vessels and their pathological changes. The clinical data obtained justify the assumption that REG may be used as a method of registering psychic stress. Such a possibility is confirmed by investigations of the cerebral blood circulation and of mental fatigue. Even brief intense psychic activity causes such changes in the cerebral blood circulation that it is expressed in the parameters of the rheoencephalogram. Author

N70-37074# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
A STUDY OF THE INTERNAL CONTAMINATION LEVELS RESULTING FROM Sr-90 and Cs-137 ENVIRONMENTAL POLLUTION: INFLUENCE OF DIFFERENT FACTORS [ETUDE DES NIVEAUX DE CONTAMINATION INTERNE RESULTANT D'UNE POLLUTION DE L'ENVIRONNEMENT PAR LE Sr-90 ET Cs-137: INFLUENCE DES DIFFERENTS PARAMETRES]
Arlette Garnier Feb. 1970 105 p refs In FRENCH; ENGLISH summary
(Contract EURATOM-003-63-10-PSAF)
(CEA-R-3861; EUR-4146-f) Avail: CFSTI

The amounts of Sr-90 and Cs-137 dietary intakes as a function of age were evaluated with a view to assessing internal exposure doses and estimating the critical age, and also to study the relative significance of the several factors involved. The data were derived from dietary surveys made in eleven European areas from which the evolution of the consumed amounts of thirteen groups of foodstuffs, as a function of age, was derived and the mean parameters of contamination transfer were deduced. The variability of some of these parameters was very large and an attempt was made to assess their effect on the total contamination. An attempt was also made to assess doses as a function of age in the case of protracted exposure using the above results and radiobiological factors derived from the literature. Author (ESRO)

N70-37080# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
THE STUDY OF THE STABILITY, AFTER GAMMA-IRRADIATION, OF A FEW NEWLY PREPARED ORGANIC MOLECULES [ETUDE DE LA STABILITE, APRES IRRADIATION GAMMA, DE QUELQUES MOLECULES ORGANIQUES NOUVELLES]
Charles Megemont, Claude Felix, and Michel Sy Apr. 1970 23 p refs In FRENCH; ENGLISH summary
(CEA-R-3962) Avail: CFSTI

Radioactivity measurements led to the examination of the stability of twelve new organic molecules after irradiation with increasing fluxes of gamma-rays. This work includes a short review of papers on the main properties of uracil and thiouracil compounds, a description of experimental conditions and interpretations of the infrared spectra of the new compounds. Author (ESRO)

N70-37111# Commissariat a l'Energie Atomique, Marcoule (France). Centre de Production de Plutonium.
USE OF EXTRA-RENAL PURIFICATION METHODS IN THE TREATMENT OF TRITIATED WATER CONTAMINATION [UTILISATION DES METHODES D'EPURATION EXTRARENALE DANS LE TRAITEMENT DE LA CONTAMINATION PAR L'EAU TRITIEE]
Jacques Mirouze (Clin. Saint-Eloi, Montpellier), Charles Mion (Clin. Saint-Eloi, Montpellier), Jean-Luc Fabre (Clin. Saint-Eloi, Montpellier), Edmond Mazaury, Philippe Henry et al May 1970 87 p refs In FRENCH; ENGLISH summary
(CEA-R-3974) Avail: CFSTI

After giving a brief description of the biological and radiotoxicological properties of tritium, methods of treating contamination by tritiated water and in particular extra-renal purification methods are discussed. A method for interpreting peritonal dialysis and a study of six cases which makes it possible to envisage a biological treatment period of about thirteen hours for a normal man are described. Haemodialysis should reduce this period to under four hours. A method which takes into account the degree of contamination is also discussed. Author (ESRO)

N70-37113# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
DOSE ABSORBED IN BIOLOGICAL TISSUE IRRADIATED BY FAST MONO-ENERGETIC NEUTRONS [DOSE ABSORBEE DANS UN TISSU BIOLOGIQUE IRRADIE EN NEUTRONS RAPIDES MONOENERGETIQUES]
Helene Sklavenitis and Christian Devillers Apr. 1970 39 p refs In FRENCH; ENGLISH summary
(CEA-R-3994) Avail: CFSTI

This report describes the calculation of the energy deposition and the dose absorbed in an irradiated biological tissue equivalent medium, and relates to radioactivation quantitative analysis by means of wide beams of fast monoenergetic and unidirectional neutrons. The results are compared to similar data obtained with energies of 10, 2, and 0.5 MeV. The method is then applied to neutron energies of 14.75 and 3.6 MeV. Author (ESRO)

N70-37128# Atomic Energy Commission, Las Vegas, Nev. Operations Office.
NATURAL ENVIRONMENTAL RADIOACTIVITY: AN ANNOTATED BIBLIOGRAPHY
Alfred W. Klement, Jr. Apr. 1970 72 p refs
(WASH-1081-Suppl) Avail: CFSTI

A bibliography on natural environmental radioactivity is presented which contains more than 1000 references. The material is divided into six categories: general, atmosphere, biological materials, soils, general waters, and groundwater with each category alphabetized by author. NSA

N70-37139# Commissariat a l'Energie Atomique, Cadarache (France). Centre d'Etudes Nucleaires.
BIBLIOGRAPHICAL REPORT: WHOLESOMENESS STUDIES RELATIVE TO IRRADIATED STARCHY FOOD AND SUGARS [RAPPORT BIBLIOGRAPHIQUE: LES ETUDES D'INNOCUITE RELATIVES AUX ALIMENTS AMYLACES ET AUX SUCRES IRRADIES]
Gerard Berger Mar. 1970 36 p refs In FRENCH; ENGLISH summary
(CEA-BIB-178) Avail: CFSTI

This report analyzes some 110 articles published since 1955 on wholesomeness trials of irradiated starchy food and sugars. Synthetic diets containing irradiated starch were tested on higher animals and they generally ensure a normal species growth. The growth of Aspergillus Orizae was not reduced by 3 Mrad doses of irradiated starch. Work on higher animals with potatoes, corn, maize and diets containing glucose or starch which had been treated with pasteurizing or sterilizing doses greater than 200 krad and nutrition experiments on man are discussed. Toxicity studies on irradiated sugars using microorganisms or tissue cultures are reviewed. Trials with caffein and alcohol and experiments on insects are treated. Author (ESRO)

N70-37279# Joint Publications Research Service, Washington, D.C.
CHEMICAL CONTINUUM OF BRAIN AS A MECHANISM OF REFLECTION OF REALITY
P. K. Anokhin 14 Aug. 1970 17 p refs Transl. into ENGLISH from Vopr. Filosofii (Moscow), no. 6, 1970 p 107-118

(UPRS-51176) Avail: CFSTI

Based on the theory of reflection, it is suggested that the fundamental law of the inorganic world, the space-time continuum, determines all forms of behavior of life from the primitive forms to man. The appearance of life on earth means that all macroprocesses occurring over long time intervals are reflected in the microworld of molecular reactions of living matter. Conditions for leaping ahead into the future were produced, and adaptatory behavior appeared in the highest degree. Author

N70-37320# Bureau of Radiological Health, Rockville, Md. Div. of Biological Effects.

RADIATION BIO-EFFECTS Summary Report, Jan. – Dec. 1969

William A. Mills and Donald M. Hodge, ed. 1970 240 p refs

(PB-190110; DBE-70-1) Avail: CFSTI CSCL 6/18

This report summarizes the activities of the Division of Biological Effects during 1969. The investigations of Epidemiologic Studies Branch and the Experimental Studies Branch which comprise the division are discussed. Titles of papers that division investigators have prepared for presentation and those appearing in print during the year are listed. Author (USGRDR)

N70-37333# Interior Dept., Washington, D.C. Office of Library Services.

MERCURY CONTAMINATION IN THE NATURAL ENVIRONMENT: A COOPERATIVE BIBLIOGRAPHY

Jul. 1970 40 p refs

Avail: CFSTI

Environmental contamination by mercury is a current concern of many bureaus and offices of the U.S. Department of the Interior. The purpose of this bibliography is to provide access to the literature related to this subject. Publications providing background and current information have been selected from the large body of literature on mercury. English language material relating to fish, wildlife and water pollution has been given full coverage from the sources consulted. Author

N70-37340# Public Health Service, Las Vegas, Nev. Southwestern Radiological Health Lab.

PARTICULATE EFFLUENT STUDY, PHOEBUS 1B, EP-4

Apr. 1970 53 p refs

(AEC Order SF-54-373; Proj. Rover)

(SWRHL-46-r) Avail: CFSTI

The reactor test was part of the Project Rover Program. Particles were found out to 82 miles from the test cell with the results indicating a decrease in deposition (particles/unit area) with distance to about the 2.5 power. The particle size distribution, of all the particles collected, is reasonably described by a log normal distribution with a geometric mean diameter of about 12 microns and a geometric standard deviation of 2.7. A regression analysis indicated a decrease in particle size and activity with distance. Isotopic results showed a large degree of fractionation of the fission products found in the particles. Electron microprobe analysis indicated uranium, carbon, and oxygen to be present in most of the particles analyzed. Particles were transported into the off-site area. The resulting ground concentrations were about 1 particle/100 sq m or less and there was no known interaction of particles with people from the general population. It is concluded there was no hazard to the public from the particulate effluent. Author (NSA)

N70-37398*# Wisconsin Univ., Madison. Dept. of Horticulture.

ENDOGENOUS SHORT PERIOD RHYTHMS IN THE MOVEMENTS OF UNIFOLIATE LEAVES OF PHASEOLUS ANGULARIS WIGHT

D. K. Alford and T. W. Tibbitts 30 May 1970 16 p refs

(Grant NGR-50-002-109)

(NASA-CR-112848) Avail: CFSTI CSCL 06C

Rhythmic rotational movements with the midvein as the axis were observed in the unifoliate leaves of Phaseolus angularis Wight grown under controlled environmental conditions with continuous light. The mean period of this movement for all leaves was 53.2 min. + or – 4.3 min. and remained constant as the leaf matured, except after removal of the apical meristem and emerging trifoliate leaf when the period increased about 5 min. The amplitude of the movement also remained constant as the leaf matured. The rotational movements were pronounced when the leaf blade was in a horizontal position and were not evident during the downward or sleep movements of the leaf. This movement began 3 days after leaf unfolding and continued for at least 6 days. It was most pronounced at the time of inflection of the leaf length growth curve after the logarithmic phase of growth. Author

N70-37403*# Stanford Univ., Calif. Instrumentation Research Lab.

CYTOCHEMICAL STUDIES OF PLANETARY MICROORGANISMS: EXPLORATIONS IN EXOBIOLOGY Summary Report, 1 Jul. 1969 – 1 Jul. 1970

Joshua Lederberg 1 Jul. 1970 41 p

(Grant NGR-05-020-004; Contracts NIH 69-2084; F44620-67-C-0070; Grants NIH GM-17367; NIH AM-12797 et al)

(NASA-CR-112847; SU-IRL-1110) Avail: CFSTI CSCL 06M

Progress is reported on the determination of optical activity by gas liquid chromatography, gas chromatography of amino acids, the reaction of chlorine with DNA, analysis of lunar samples from Apollo 11 and 12 for carbon compounds and porphyrin-like pigments, mass spectrometry of 1-phenylethyl carbamates, analysis of natural products by mass spectrometer, the use of artificial intelligence in the solution of problems in analytical organic chemistry, research in computer instrumentation of laboratory instruments, cell separation, a high speed fluorescent cell sorter, optical data processing, a quasi-microscope for the Viking Mars Lander, and Mariner Mars 1971 Orbiter photography. R.B.

N70-37428# Oak Ridge National Lab., Tenn.

PROCEEDINGS OF CONFERENCE ON INHALATION CARCINOGENESIS

Apr. 1970 524 p refs Held at Gatlinburg, Tenn., 8-11 Oct. 1969 Sponsored in part by AEC Prepared in cooperation with Natl. Cancer Inst. *Its* AEC Symp. Ser. 18

(CONF-691001) Avail: CFSTI

Twenty-five symposium papers are presented under the following headings: current studies in inhalation carcinogenesis, respiratory carcinogenesis, cellular and functional injury following inhalation exposure, inhalation technology, and relation of inhalation exposure to carcinogenesis. E.C.

N70-37433# Sacramento Regional Area Planning Commission, Calif.

THE AIR POLLUTION THREAT

Larry Faith Oct. 1969 76 p refs Supported in part by HUD

(PB-191382) Avail: CFSTI CSCL 13B

Contents: General inventory of air pollution sources and emissions; A summary of federal, state, and local air pollution laws; The quality of air in the sacramento regional area; Projections of population, vehicles, and activities to 1990; Air quality in the Sacramento Region in 1990; Suggested air quality goals - Short term and long term; Alternative governmental organizations to deal with air pollution; A suggested program for the Sacramento Region; Budget requirements for a six county regional air quality control district; Citizen attitudes on air quality. USGRDR

N70-37435# Argonne National Lab., Ill.

RADIOLOGICAL PHYSICS DIVISION Annual Report, Jul. 1968 – Jun. 1969

Jun. 1969 233 p refs

(Contract W-31-109-eng-38)
(ANL-7615) Avail: CFSTI

Research concerning toxicity of radioelements is reported, including separation of cesium and rubidium by the ferrocyanides of copper, zinc, and zirconium; application of cellulose nitrate films for alpha autoradiography of bone; regularization unfolding in low gamma ray activity measurements for one dimensional scanning and for two dimensions; retention of Ba-133 in beagles; and natural thorium in human bone. Meteorological research includes Chicago air pollution system model experimental studies and case studies; the use of pyrheliometers for continuous measurements of an effective air pollution mixing depth; and a tabulation technique for forecasting concentrations of urban air pollutants. Radiation physics studies concern fluorescence polarization; electro-optical techniques for ultrasensitive radiophotoluminescent dosimetry; permanent damage of Li(7)F thermoluminescent dosimeters by fast neutrons; specific primary ionization; and the effect of pressure upon ionization in pure rare gases. In the field of bio-environmental studies, the behavior of fallout Cs-137 in aquatic and terrestrial environments was studied. P.A.B.

N70-37461*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
STERILIZATION OF UNMANNED PLANETARY SPACECRAFT, A REPORT ON CURRENT TECHNOLOGY
F. J. Beyerle and E. B. Snow 12 Sep. 1970 52 p refs
(NASA-TM-X-53884; MSFC-R-ME-IN-67-5) Avail: CFSTI CSCL 06M

The overall philosophy of spacecraft sterilization is discussed, and the present state of the art of NASA policy is presented. Biological considerations necessary for the implementation of a planetary quarantine policy are outlined, and facilities and sterilization methods are discussed. The sterilization considerations required at each stage in the planning of a mission are discussed, and the present status of technological development in each phase of mission programming is presented, with special emphasis on problem areas and those which need further definition. Author

N70-37467*# Texas Christain Univ., Fort Worth. Dept. of Psychology.
DISTANCE AND RATE JUDGMENTS IN SIMULATED SPACE Final Report, 1 Sep. 1967 – 30 Nov. 1969
Malcolm D. Arnoult and Robert P. Markley 30 Nov. 1969 5 p
(Grant NGR-44-009-018)
(NASA-CR-112843) Avail: CFSTI CSCL 05E

A description is presented of a space visual simulator for producing continuously variable images of a scale model target by reflecting light from the target through a set of five lenses. A unique feature of the apparatus is that the simulated distance is achieved by having the apparent source of the light rays appropriate to the distance being represented, and by having an image which is actually three-dimensional. Studies of distance judgment were conducted using both verbal and nonverbal response measures. D.L.G.

N70-37468*# Michigan Univ., Ann Arbor. Inst. of Science and Technology.
INSTITUTE OF SCIENCE AND TECHNOLOGY Progress Report, 15 Apr. 1969 – 15 Apr. 1970
Ward Edwards 20 Apr. 1970 25 p
(Grant NGL-23-005-171)
(NASA-CR-112842; PR-3) Avail: CFSTI CSCL 05E

Experiments are discussed involving the application of multi-levsl inference systems to aerospace engineering. The human factors role in man machine systems for information processing is of prime concern in these experiments, and specific areas of interest include: (1) the role of computer displays and controls in probablistic information processing; (2) misaggregation vs. misperception; (3) group vs. individual performance in inference and decision making; and (4) multiattribute utilities as tools for selection, scheduling, and rescheduling of experiments for manned space flights. D.L.G.

N70-37471*# Scientific Translation Service, Santa Barbara, Calif.
ENZYMATIC PROCESSES ON MEMBRANE MODELS [FREMENTATIVNYE PROTSESSY NA MODELNYKH MEMBRANAKH]
G. A. Deborin Washington NASA Sep. 1970 10 p refs Transl. into ENGLISH from the book 'Abiogenez i Nachalnyye Stadii Evolyutsii Zhizni' Moscow, Nauka Press, 1968 p 63–68
(Contract NASw-2035)
(NASA-TT-F-13185) Avail: CFSTI CSCL 06A

The results of a study of enzymatic activity in an experimental setup with a lipid membrane separating the enzyme (ribonuclease) from the substrate (RNA) are given. The migration of the enzyme through the membrane to the RNA is investigated. Considerations are given concerning the role of membranes in controlling the enzymatic activity in the biological cell. Author

N70-37473*# Scientific Translation Service, Santa Barbara, Calif.
THE EARLIEST FORMS OF LIFE IN NORTHERN EURASIA
A. G. Vologdin Washington NASA Sep. 1970 9 p Transl. into ENGLISH from the Russian
(Contract NASw-2035)
(NASA-TT-F-13189) Avail: CFSTI CSCL 06C

Application of the paleontological method of studying sedimentary deposits to an investigation of the earliest forms of life is discussed. A study of cross sections of many rock formations in the USSR, Mongolia, China, Czechoslovakia, and Poland resulted in the observation and partial recording of vestiges of a number of groups of organisms which clearly belong to various stages of the development of life during Precambrian times. The data collected supplement the small amount of data available in foreign countries on vestiges of organisms by citing a large number of new species of blue-green algae. Vestiges of simple life forms such as jellyfish and sponges were also discovered. The earliest forms of organisms on the territory of the USSR were established as being about 2.6 billion years old which definitely cannot be considered as the time of origin of life. Author

N70-37490*# Scientific Translation Service, Santa Barbara, Calif.
CARBOHYDRATE METABOLISM IN INVERTEBRATES: TRENDS IN ITS EVOLUTION
F. F. Soprunov Washington NASA Sep. 1970 14 p refs Transl. into ENGLISH from the Russian
(Contract NASw-2035)
(NASA-TT-F-13190) Avail: CFSTI CSCL 06B

Experiments were conducted to determine the carbohydrate metabolism and tissue respiration in deep water holothurians. The ferricyanidreductase activity of the homogenate incubated at 750 atm pressure was compared with the ferricyanidreductase activity for incubation in the same medium, but at atmospheric pressure. It is concluded that the transfer from the original fermentative processes to aerobic metabolism proceeded step by step. Author

N70-37500*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EFFECT OF CURRENT CLEANING PROCEDURES ON STERILIZATION OF SPACECRAFT COMPONENTS
12 Sep. 1969 16 p refs
(NASA-TM-X-53885) Avail: CFSTI CSCL 06M

The effect of cleaning procedures on sterilization of spacecraft components is discussed. Spacecraft components consisting of aluminum panels and stainless steel tubes were cleaned using the nonviable procedures. The cleaning process significantly reduced the biological load on the test specimens but did not sterilize the spacecraft components. Author

N70-37502*# Scientific Translation Service, Santa Barbara, Calif.
ULTRAVIOLET RAYS AND ONE-CELLED ORGANISMS
M. M. Kamshilov Washington NASA Sep. 1970 8 p refs Transl. into ENGLISH from the Russian
(Contract NASw-2035)
(NASA-TT-F-13188) Avail: CFSTI CSCL 06M

Research aimed at determining the effect of ultraviolet radiation on one-celled organisms is reported. Investigative results indicate the following: (1) Sensitivity to UV radiation is substantially different for various strains of red yeast. (2) Selection on the basis of resistance to UV rays may significantly increase the radiation resistance of the flagellates and red yeasts. (3) Resistant strains of flagellates and red yeasts resulting from systematic irradiation differ from strains without irradiation in their increased growth rate. (4) Weak doses UV radiation stimulated cell division in the flagellates, infusorians, and red yeasts, and increase motor activity in the flagellates and infusorians. D.L.G.

N70-37519# Metropolitan Regional Council, Inc., New York.
AIR POLLUTION ABATEMENT. A REPORT TO LOCAL GOVERNMENT OFFICIALS ON THE ESTABLISHMENT OF AIR QUALITY CONTROL STANDARDS FOR THE NEW JERSEY-NEW YORK-CONNECTICUT INTERSTATE AIR QUALITY CONTROL REGION
Alan Neustadter Dec. 1969 47 p refs Sponsored in part by HUD
(PB-191389) Avail: CFSTI CSCL 13B

The production of pollutants and an increasing need for pollution control standards are an inevitable consequence of technological society with a high standard of living. The pervasive nature of air pollution in the New Jersey-New York-Connecticut metropolitan region, its disregard or politico-geographic boundaries, including both state and local levels, and the national character of the technical, health, economic and political problems involved have made it necessary for the Federal government to assume leadership and exert its influence in developing a pollution abatement program on a national scale. Inherent within this approach is the concept that proper effectuation can only be achieved through active participation and total commitment at the state and local levels. USGRDR

N70-37531*# Scientific Translation Service, Santa Barbara, Calif.
COMPARATIVE STUDY OF SPECIFIC PROPERTIES OF VARIOUS FORMS OF TRANSPORTABLE (SOLUBLE) RIBONUCLEIC ACIDS AND AMINOACYL-R N A-SYNTHETASES [IZUCHENIE SPETSIFICHNOSTI TRANSPORTNYKH (RASTVORIMYKH) RIBONUKLEINOVYKH KISLOT I AMINOTASIL-RNK-SINTETAZ V SRAVNITELNOVIDOVOM ASPEKTE]
G. N. Zaytseva Washington NASA Sep. 1970 8 p refs Transl. into ENGLISH from the book 'Abiogenez i Nachalnyye Stadii Evolyutsii Zhizni' Moscow, Nauka Press, 1968 p 92–96
(Contract NASw-2035)
(NASA-TT-F-13186) Avail: CFSTI CSCL 06A

Research conducted on the protein biosynthesis of four Chordata classes, invertebrates, higher plants, and microorganisms is described. The following were investigated: bobyx mori, saccharomyces cerevisiae, bac. brevis, and A. vinelandii. The genetic code is described. Author

N70-37559*# Translation Consultants, Ltd., Arlington, Va.
THE ROLE OF MEDIATORS IN INDIVIDUAL DEVELOPMENT AND THE CHANGE IN THEIR FUNCTIONS IN THE PROCESS OF EVOLUTION
G. A. Buznikov and I. V. Chudakova Washington NASA Sep. 1970 10 p Transl. in ENGLISH from the RUSSIAN
(Contract NASw-2038)
(NASA-TT-F-13191) Avail: CFSTI CSCL 06C

The function of mediators in ontogenesis was examined. A change in their function from that of mitotic regulator to local hormone and finally to mediator is proposed. The presence is confirmed of mediatory substances in prenatal evolutionary stages. Author

N70-37564*# Scientific Translation Serv, Santa Barbara, Calif.
RESPIRATORY SYSTEM OF BACTERIA IN THE LIGHT OF EVOLUTION [DYKHATELNYI APPARAT BAKTERII V SVETE EVOLUTSII]
N. S. Gelman Washington NASA Sep. 1970 9 p refs Transl. into ENGLISH from the book 'Abiogenez i Nachalnyye Stadii Evolyutsii Zhizni' Moscow, Nauka Press, 1968 p 114–118
(Contract NASw-2035)
(NASA-TT-F-13187) Avail: CFSTI CSCL 06M

The functions of membranous structure in bacteria are described in view of recent research results. Research of the membranes of Micrococcus lysodeikticus was conducted by two methods: breakdown of the membranes with EDTA and digestion of the membranes with lipolitic and proteolitic enzymes. Electrostatic bands were analyzed. Author

N70-37576# Johns Hopkins Univ., Baltimore, Md. Myocardial Infraction Research Unit.
[MYOCARDIAL INFRACTION RESEARCH UNIT] Annual Report, 1969
1969 203 p refs
(Contract PH-43-67-1444)
(PB-190112) Avail: CFSTI CSCL 06E

Contents: Administration-operation-personnel; Clinical-core studies; Data management; Pathological studies; Animal studies. Author (USGRDR)

N70-37581# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
Tc 99m-IRON (II) COMPLEX: A NEW SUBSTANCE FOR BRAIN TUMORS SCINTIGRAPHY
K. J. Schmidt et al Nov. 1969 5 p refs Transl. into ENGLISH from Atompraxis (West Germany), v. 14, no. 415, 1968 p 5–68
(LIB/Trans-237) Avail: AEC Depository Libraries

The application of Tc-99 labeled iron(II) complex for the brain tumor scintigraphy was found to be superior to Tc-99 labeled pertechnetate. The advantages of the complex lie in the relatively rapid decrease of the activity concentration in the blood because of excretion via the kidneys and in the enrichment of activity in the tumor. The radiation dose to the patient is also relatively low. The critical organ is the kidney, which is exposed to between 10 to 20 rads, when 20 mCi of Tc-99 labeled iron(II) complex is applied. NSA

N70-37585*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EVALUATION OF ALCOHOL SPORULATION METHOD
12 Sep. 1969 26 p refs
(NASA-TM-X-53891; MSFC-IN-R-ME-68-5) Avail: CFSTI CSCL 06M

An alcohol suspension of Bacillus subtilis variety niger spores was employed as an agent for controlled contamination of stainless steel strips. Test results indicate that this new method will provide a more accurate and controlled level of contamination and will result in cost and time reduction. The complete procedure to be followed is included. Author

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N70-36244# Melpar, Inc., Falls Church, Va
STUDY OF ADAPTIVE MATHEMATICAL MODELS FOR DERIVING AUTOMATED PILOT PERFORMANCE MEASUREMENT TECHNIQUES. VOLUME 1: MODEL DEVELOPMENT Final Report, Jan. 1968 - Jan. 1969
Edward A. Connally, Alfred R. Schuler, and Patricia A. Knoop Oct. 1969 316 p refs
(Contract F33615-68-C-1278)
(AD-704597; AFHRL-TR-69-7-Vol-1; Rept-8054) Avail: CFSTI CSCL 5/9

The report documents research on a new approach to deriving human performance measures and criteria for use in automatically evaluating trainee performance. The ultimate application of the research is to provide methods for automatically measuring pilot performance in a flight simulator or from recorded in-flight data. An efficient method of representing performance data within a computer is described. A system of adaptive mathematical and computer models is developed to examine representative performance data corresponding to known skill-levels and to independently develop a unique method of performance evaluation. Three types of models are developed, each of which is designed to derive and use (in an adaptive performance evaluation scheme) unique types of performance measures. Author (TAB)

N70-36340# Harris Research Labs., Inc., Rockville, Md.
THE COMFORT AND FUNCTION OF CLOTHING Technical Report, 1941 - 1969
Lyman Fourt and Norman R. S. Hollies Natick, Mass. Army Natick Labs. Jun. 1969 304 p refs
(Contract DAAG17-67-C-0139)
(AD-703143; TS-162; TR-69-74-CE) Avail: CFSTI CSCL 15/5

The matters discussed are: clothing as a quasi-physiological system interacting with the body; means of describing the thermal and moisture relations and experimentally determining characteristic coefficients of clothing; the more usual structural description of clothing, and some of the possible variations of its structure or design; heat and moisture relations in clothing; physiological and field testing of clothing by wearing it; properties of clothing that require tests on living subjects; means of testing physical properties of clothing which are related to comfort; differences between fibers in relation to comfort, both thermal or moisture relations and nonthermal. Author (TAB)

N70-36362*# Indiana Univ., Bloomington. Div. of Optometry.
THE VISUAL STANDARDS FOR THE SELECTION AND RETENTION OF ASTRONAUTS
Merrill J. Allen, David P. Austen, Arthur E. Jones, John R. Levene, and Stanley Miller Jun. 1970 124 p refs
(Contract NAS9-9665)
(NASA-CR-108587) Avail: CFSTI CSCL 06N

The purpose is to determine the origin and adequacy of the vision standards being used for the selection and retention of astronauts and scientist astronauts. A broad based literature search was carried out to evaluate the adequacy of vision test standards. The voluminous literature is indicated by the abstracts included in this report. The coverage of the literature is not exhaustive but does include the main publications on vision standards for aviators. From the literature it is apparent that many of the vision tests and procedures are inadequate or out of date and that certain physiological aspects of vision that are of importance to aviators and astronauts have been neglected or overlooked. The primary oversight of immediate concern relates to testing for near vision capabilities. Author

N70-36364# Naval Air Development Center, Johnsville, Pa. Aerospace Crew Equipment Dept.
DESCRIPTION AND EVALUATION OF A PORTABLE DRY-ICE WATER-CONDITIONED SUIT SYSTEM FOR AIRCREW MEMBERS Interim Report
John J. Esposito 6 Nov. 1969 23 p refs
(AD-700915; NADC-AC-6906) Avail: CFSTI CSCL 6/17

A portable water-conditioned suit system, employing a dry-ice cooler designed and constructed at the Naval Air Development Center and a commercially available water-cooled vest, was evaluated by exposing two sitting-resting subjects at sea level pressure to environments of 105F and 115F. Tests were conducted with and without the cooling system. Sublimation of approximately fifteen pounds of dry-ice kept the subjects relatively free from evidences of heat stress for periods of four hours at 115F. Based on a comparison with a wet-ice system, the dry-ice portable cooler, possessing significant advantages in terms of size and weight, produced equivalent cooling of the subjects. Author (TAB)

N70-36396# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STATISTICAL CHARACTERISTICS OF IMAGES AS INDICATORS OF FORMS
I. S. Goryan et al 15 Aug. 1969 13 p refs Transl. into ENGLISH from Vopr. Bioniki (Moscow), 1967, p 118 - 124
(AD-700581; FTD-HT-23-1410-68) Avail: CFSTI CSCL 6/4

Research by various scientists in the field of distinguishing textures by statistical analysis is reviewed. The study of bees ability to distinguish textures synthesized into statistical patterns by computers is included. The necessity for several parameters (rather than a single one) to make a meaningful texture classification is mentioned, as are methods of calculating surfaces. Work on the statistics of building a visual system is discussed briefly. The use of n-grams and difficulties presented with the increase of n are noted. The results of experiments on the physiology of animal vision are mentioned. TAB

N70-36414*# Hamilton Standard, Windsor Locks, Conn.
INDEPENDENT RESPIRATORY SUPPORT SYSTEM Final Report, 2 Sep. 1969 - 31 Mar. 1970
Douglas C. Howard Mar. 1970 29 p
(Contract NASw-1972)
(NASA-CR-112402; SVHSER-5661) Avail: CFSTI CSCL 06K

Various forms of respiratory and circulatory disease produce chronic hypoxia at metabolic rates above resting. Short-term oxygen therapy will alleviate this condition for time periods up to two or three hours, depending on the severity of the ailment and the level of metabolic expenditure assumed. The objectives were: (1) to define a first-cut system of low weight and volume satisfying a specific level of metabolic support; (2) fabricate three units as defined by the first objective; and (3) define an improved system based on user evaluation of the delivered units and detailed engineering studies. Three units were built having weights of 7.7 lbs and volumes of 210 cubic inches each. One such unit will provide 0.5 to 2.5 liters per minute of 100% oxygen to the nasal passages for durations of 2.5 to 0.5 hours, respectively. The operation of these units to date has been entirely satisfactory. Studies in support of the third objective indicate that optimized system weight and volume goals of 5 lbs and 165 cubic inches are not unreasonable. Additionally, a fluidics circuit would provide a demand capability permitting flows of 1 to 2 liters per minute for time periods up to four hours. Author

N70-36454# Human Resources Research Organization, Alexandria, Va.
EVALUATION OF THE INTEGRATED CONTACT-INSTRUMENT CONCEPT FOR ARMY FIXED WING FLIGHT INSTRUCTION
Wallace W. Prophet and Oran B. Jolley Dec. 1969 108 p refs
(Contract DAHC19-70-C-0012)
(AD-703161; HumRRO-TR-69-26) Avail: CFSTI CSCL 5/9

The report describes the results of an experimental comparison of three primary fixed wing flight training methods: (a) integrated

contact-instrument primary flight training administered in a side-by-side seating aircraft; (b) non-integrated primary flight training administered in a side-by-side seating aircraft; and (c) non-integrated primary flight training administered in a tandem-seating aircraft. Author (TAB)

N70-36457# Human Resources Research Organization, Alexandria, Va.
ORIENTATION SYSTEMS: FIRST THINGS FIRST
Robert H. Wright Feb. 1970 16 p *Its* HumRRO Professional Paper No. 3-70
(Contract DAHC19-70-C-0012)
(AD-705021) Avail: CFSTI CSCL 5/5

The geographic orientation requirement for the Armys lighter aircraft, and for Army aviation as a system, is a system-analysis and system-design problem that appears to have defied solution. The factors considered in this paper indicate that the requirement is not filled simply by a more sophisticated machine system approach. Instead, the man part of the man-machine system needs to be deliberately designed in to contribute his full potential as a functional part of the system. Also, the Army aviation operational environment, with all of its complex interacting coordination requirements, needs to be considered, for an affordable and operationally effective geographic orientation system. Author (TAB)

N70-36467# School of Aerospace Medicine, Brooks AFB, Tex. Internal Medicine Branch.
EXTERNAL MEASUREMENT OF Fe 59 FERROKINETICS
Donald F. Logsdon, Jr., James F. Green, and John W. Harper Mar. 1970 12 p refs
(AD-705046; SAM-TR-70-11) Avail: CFSTI CSCL 6/5

A counting system has been assembled for the determination of circulating radioisotope activity by means of external measurement of the ventral surface of the wrist. The system was tested on one patient by performing a ferrokinetics study with 59Fe, in which both the external counting system and the normal blooddrawing procedure were used. The external counting system proved to be unsuitable for measurement of plasma iron clearance, but was able to measure accurately the percentage uptake of iron into new red cells. The use of the external counting system eliminates the need for 10 of the venipunctures and 70 ml. of blood. Author (TAB)

N70-36480# Sperry Rand Corp., Great Neck, N.Y. Gyroscope Div.
RESEARCH IN VISUAL PERCEPTION FOR CARRIER LANDING Final Report, 1964–1969
Theodore Gold and Robert F. Perry Dec. 1969 88 p refs
(Contract NOnr-4081(00))
(AD-706036; SGD-5265-0327) Avail: CFSTI CSCL 5/10

The effects of ship motion and the Fresnel Lens Optical Landing System (FLOLS) on the accuracy and consistency with which Navy pilots can estimate position on the glide slope and flight path (aim point) during carrier landing were determined. The visual judgements of the pilots were obtained in simulated dusk and night landings. Comparable data were obtained also for landings on a carrier without the presence of angular deck motion. A visual carrier landing simulator which was developed for a previous study was modified to incorporate provisions for carrier deck motion and a stabilized FLOLS. Three qualified carrier pilots with experience as Landing Signal Officers participated as test subjects. More than 5000 data points were collected in the glide slope studies, and about 4000 data points were accumulated in the aim point studies. These data were evaluated by a psychometric technique which permitted independent measures of response bias, sensitivity to changes in stimulus, and variability in response. Author (TAB)

N70-36493* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
LIFE PRESERVER Patent
Matthew I. Radnofsky and Glenn A. Shewmake, inventors (to NASA) Issued 13 Oct. 1964 (Filed 15 Feb. 1963) 8 p Cl. 9-316
(NASA-Case-XMS-00864; US-Patent-3,152,344; US-Patent-Appl-SN-258932) Avail: US Patent Office CSCL 06G

With the object of fabricating a life preserver which is easily donned, easily discarded, and no hindrance to swimming, a vest made from lightweight flexible materials and without fastening devices of any kind is described. The preserver is comprised of a nylon inflatable structure provided with internal restraining members which cause it, upon being inflated, to assume a ram's horn configuration. The device is provided with an oral inflation tube; a compressed gas cartridge assembly is used for rapidly inflating the preserver. When deflated, the life vest reduces to a small and light compact package. P.A.B.

N70-36500# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EVALUATION OF TWO METHODS FOR INSTRUCTING A CLASSIFIER
Y. Yu Chyarnysauskas et al Sep. 1969 13 p refs Transl. into ENGLISH from Tr. Fiz.-Mat., Khim., Geol. i Tekhn., Akad. Nauk Lit (USSR), no. 2, 1967 p 115–120
(AD-700806; FTD-HT-23-520-68) Avail: CFSTI CSCL 9/2

One of the problems in creating learning recognition systems is selecting a method of instruction which will assure maximum accuracy of recognition at the highest rate of convergence of the instruction process. Two methods of instructing a classifier are compared: the method used in the Adaline system and an instruction system in which the method of stochastic approximation is used. Accuracy of recognition and the convergence rate of the instruction process were selected as criteria for evaluating the quality of instruction. Author (TAB)

N70-36510# Flying Personnel Research Committee, London (England).
AN ASSESSMENT OF INDUSTRIAL SAFETY HARNESSES
D. C. Reader Jul. 1969 23 p refs
(FPRC/MEMO-248) Avail: CFSTI

The range of commercially available safety harnesses and belts was examined to discover the most suitable assemblies for use by personnel servicing large aircraft. The harnesses and belts were assessed for fit, ease of use, and comfort when worn by human subjects during the arrest of a free fall and subsequent suspension. No failures of harnesses or belts were observed during the experiments. It was found that, after modification, the Barrow, Hepburn and Gale Cat. No. 49 harness, the Irving type SH/5 harness and the GQ Safety Harness and Suit are suitable for use by aircraft servicing personnel. Author

N70-36541# Naval Medical Research Inst., Bethesda, Md.
ANALYSIS OF BIOMEDICAL DATA BY TIME-SHARING COMPUTERS. 1: NON-LINEAR REGRESSION ANALYSIS Medical Research Interim Report
David L. Horwitz and Louis D. Horner 28 Feb. 1970 19 p refs
(AD-704858; NAVMED-MR005-20-0287-25) Avail: CFSTI CSCL 12/1

Analysis of biomedical data frequently involves obtaining a mathematical equation to describe numerical data. Because of the nature of biological systems, the desired equations are often not linear. In the past, such non-linear systems were often avoided because mathematical methods for analyzing them were tedious and, occasionally, quite imprecise. Modern computers have made such systems far easier to work with. The publication describes a program for obtaining these non-linear regression equations. The

program described has a number of advantageous properties: (1) it can be used for almost any type of equation, including exponential, logarithmic, and power functions; (2) it is written in the BASIC program language, which can be learned by a person without computer knowledge in only a few hours; (3) it is designed for time-sharing computers, so that the user may readily interact with the computer and modify the equations being used at will; and (4) the output of the program includes sufficient statistical parameters to enable further evaluation of the results. In addition to giving the program, the publication gives full instructions on its use, suggestions for modifying the program for additional applications, and several illustrative examples. TAB

N70-36835# Department of Labor, Washington, D.C. Bureau of Labor Standards.
THE INORGANIC ACIDS
1969 30 p refs revised *Its* Bull. No. 265
Avail: SOD $0.25

Properties and characteristics of the common commercial forms of inorganic acids are presented. Potential hazards of inorganic acid groups are discussed, as well as their control and preventive measures, packaging, handling, storage, labeling, waste disposal, and first aid procedures. Unique characteristics or hazards of individual acids such as chromium trioxide, hydrochloric, hydrogen fluoride, nitric, perchloric, and sulfuric acids are cited. Physical ind chemical properties of the inorganic acids and emergency procedures are tabulated. J.M.

N70-36775*# Pillsbury Mills, Inc., Minneapolis, Minn.
MAXIMUM VARIETY FROM FEEDING UNIT OF LOW WEIGHT AND BULK Final Report, May 1968–Sep. 1969
James Blodgett Nov. 1969 74 p refs
(NASA Order R-22-015; Contract DAAG17-68-C-0148)
(NASA-CR-112676; TR-70-29-FL; FL-103) Avail: CFSTI CSCL 06H

Information is presented for the preparation of 7 improved food bars and 11 improved adjunct cubes which, when combined in defined combinations, yield 32 familiar meal items. Five dual function food bars were also prepared. Dual function bars may be consumed as is or hydrated to yield a familiar food item. Two coatings were prepared which, when applied to the food bars and adjunct cubes, prevent attrition and fragmentation during handling. Meal items prepared from the above coated components which had been stored for four months at 38 degrees C in N2 filled cans were found acceptable when evaluated by a 30-man panel. Hedonic ratings for the prepared meal items before and after storage with data on microbiological and moisture changes during storage and data to indicate coating effectiveness are also given. Author

N70-36861# Department of Civil Aviation, Melbourne (Australia). Aviation Medicine Branch.
THE PRESENTATION OF PRINTED INFORMATION TO AIRCRAFT PILOTS
R. D. Watkins (Melbourne Univ.) Apr. 1970 38 p refs
(AM-Memo-27) Avail: CFSTI

The charts and printed material which are carried by pilots are listed in some detail, and the Australian and ICAO control and influence on the format and information content of these documents is described. Factors which affect the legibility of charts and printed material are discussed, and some recommendations are made. The legibility of instruments and the effect of the level of cockpit lighting on legibility are reviewed. Author

N70-36933*# TRW, Inc., Cleveland, Ohio. Mechanical Products Div.
AIRCREW OXYGEN SYSTEM DEVELOPMENT MAN-IN-THE-LOOP TEST REPORT
R. J. Kiraly, A. D. Babinsky, and J. D. Powell Jul. 1970 60 p
(Contract NAS2-4444)
(NASA-CR-73395; TRW-ER-7256-22) Avail: CFSTI CSCL 06K

Four members of the NAOS project team volunteered as test subjects for the manned testing of the flight breadboard system. Two series of tests were conducted. During the first test series each of the test subjects using aviation oxygen masks, breathed gases generated and processed by the flight breadboard system. During these tests the system was operated with and without safety pressure. When safety pressure was not used and the counter lung vented to atmosphere, the mask pressures varied between + or − 1 inch of water with respect to ambient pressure. When the counter lung was pressurized with the air pressure control regulator, resulting in a safety pressure in the rebreather loop, the extremes in mask pressure varied between atmospheric pressure and 4 inches of water above atmospheric pressure. Breathing on the system without safety pressure was found to be quite comfortable. When safety pressure was used, the requirement of making a conscious effort to exhale was found to be uncomfortable. Physiological examinations of the test subjects' respiratory system were conducted prior to and after the manned test with the oxygen system. No detrimental effects due to breathing on the system were observed in any of the test subjects' respiration characteristics. Author

N70-36936# Hudock and Hudock, Arlington, Va.
THE OPERATIONAL PROFILE AND MISSION OF THE CERTIFIED NON-INSTRUMENT RATED COMMERCIAL PILOT Final Report
Philip F. Hudock and Robert P. Hudock Jul. 1970 98 p refs
(Contract DOT-FA69-WA-2181)
(FAA-RD-70-50) Avail: CFSTI

Based on the results of a nationwide, statistically reliable survey, pilots are divided into two major operational flight profiles: the medium operation and the complex operation; and one minor profile: the military operation. Profiles are defined on a functional basis. The medium profile pilots perform primarily personal (non-commercial) flights. The complex profile pilots are primarily engaged in commercial (for-hire) flights. The complex profile is composed of three sub-profiles: (1) transportation of persons and property for hire, (2) flight instruction given, and (3) aerial application and survey. The aeronautical skills and knowledge necessary for the safe operation of the missions of each group are identified. Training and testing to a level of operational competence is suggested with separate programs for the medium and complex profiles. Author

N70-36956# Lockheed Missiles and Space Co., Palo Alto, Calif.
INFLUENCE OF OPTOKINETIC AND VESTIBULAR EFFECTS ON THE MAN-OPERATOR RELIABILITY IN CONTROL SYSTEMS OF FLYING VEHICLES
Iv. I. Kirilenko et al 1970 5 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 8, no. 3, 1970 p 476–478
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Effects of vestibular stimulation (control mode), combined vestibular and optical kinetic stimulation (summation mode), and of out-of-phase stimulation (interference mode) were correlated to work capacity reduction and reliability characteristics of human operators in the control systems of flying vehicles. Prolonged stimulation of vestibular and optical analyzers established that the distribution law capacity of the operator work-capacity was subjected to a truncated normal law. Operator reliability in the stimulant summation mode was considerably less than in either the control or interference modes. Optikinetic and vestibular effects affected tracking quality; recovery of work capacity after summation mode stimulation proceeded much slower than in either of both the single stimulation modes. G.G.

N70-37005# Joint Publications Research Service, Washington, D.C.
GROWTH OF SPACE MEDICINE, BIOLOGY HIGHLIGHTED
In its Soviet Studies on Space Topics 6 Aug. 1970 p 6-16 (See N70-37001 20-30)
Avail: CFSTI

A brief review of the development of aerospace medicine is given. Life support systems, circadian rhythms, space flight food, and physiological responses to flight stress are considered, and biological experiments are mentioned. N.E.N.

N70-37076*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
STRESS EFFECTS OF HIGH NOISE LEVELS ON LOWER BODY NEGATIVE PRESSURE EXPERIMENTS
R. E. Allen, R. L. Trobaugh, and B. B. Henson Washington Sep. 1970 49 p refs
(Contract 931-31-19-00-62)
(NASA-TN-D-5967) Avail: CFSTI CSCL 06S

The purpose of the study was to examine the effects of high noise levels on subjects experiencing lower body negative pressure. The subjects participating in the study were five males ranging from 24 to 33 years, and all were in good physical condition. Each subject was required to have hearing sensitivity within normal limits and to have had no excessive exposure to noise prior to testing. Each subject was given a complete audiological examination to determine his hearing level prior to testing. Noise levels of varying intensities were introduced through earphones to the subject while he was in the lower body negative pressure device (LBNPD). Physiological data were collected prior to the experiment to establish each subject's baseline response. The noise experiment lasted 30 minutes, and each subject experienced 4 bursts of 100 dB pink noise for a duration of 1.5 minutes each. A negative pressure of −40 mmHg was maintained for 12.5 minutes. The physiological parameters measured on each subject were EKG, blood pressure, GSR, respiratory rate, respiratory volume, lower body temperature, and upper body temperature. Ambient conditions in the laboratory were also monitored, and the testing was recorded on a tape recorder for the purpose of recall. The results indicated that 100 dB of noise given at random time intervals throughout the lower body negative pressure test produced no significant recurring effects on heart rate or blood pressure that could be credited to the noise stimulus. The introduction of noise did affect the GSR, indicating that high noise levels do produce some stress on subjects in the LBNPD. Author

N70-37137# Commissariat a l'Energie Atomique, Cadarache (France). Centre d'Etudes Nucleaires.
MATHEMATICAL PROCESSING OF SCINTIGRAPHIC IMAGES [TRAITEMENT MATHEMATIQUE DES IMAGES SCINTIGRAPHIQUES]
Henri Ottavi Dec. 1969 35 p refs In FRENCH; ENGLISH summary
(CEA-R-3920) Avail: CFSTI

A scintigraphic image always lacks sharpness, whether it be obtained using a stenopaic cine-camera, a collimating grid, or by scanning. If the object is planar, the image can be deduced from the object by a linear transformation and a method for the inversion of this transformation, which takes into account random changes in the image, is presented. From this is deduced the order of magnitude of the sharpness which one can hope to obtain from a mathematical processing of the image, taking into account the three parameters: object activity, exposure time, object distance. Author (ESRO)

N70-37216# Department of Labor, Washington, D.C. Bureau of Labor Standards.
THE FUNDAMENTALS OF ACCIDENT PREVENTION
1969 17 p refs Revised *Its* Bull. No. 247
Avail: SOD $0.15

Basic elements in industrial safety programs are outlined. Establishment of policy, delegation of authority, and assessing the progress made are discussed under management leadership. The layout of the workplace, working surfaces, tools and equipment, machine safeguarding, and materials-handling facilities are cited, as well as flammable materials, housekeeping, health hazards, and maintenance. The need for proper training and supervision is stressed. Methods for maintaining employee participation and interest in the safety committees and activities are mentioned. J.M.

N70-37224# Oxford Univ. (England). Dept. of Engineering Science.
A STUDY INTO THE AVAILABILITY OF CONTROL SITES FOR THE ACTUATION OF POWERED UPPER LIMB PROSTHESES FOR THE CONGENITAL LIMB DEFICIENT CHILD Final Report
E. E. Rogers Mar. 1970 25 p refs Sponsored by Dept. of Health and Social Security
(FR-1103/70) Avail: CFSTI

The following aspects of the work on the availability of control sites for the actuation of powered upper limb prostheses for children with congenital limb deformities (Rept-1086-69) are considered: (a) a review of 18 children in their acceptance and rejection of upper limb appliances; (b) a clinical evaluation of the Edinburgh model powered upper limb prosthesis. Author (ESRO)

N70-37511# Department of Civil Aviation, Melbourne (Australia). Aviation Medicine Branch.
CONSEQUENCES OF TINTING IN AIRCRAFT WINDSHIELDS
B. A. J. Clark Feb. 1970 51 p refs
(AM-Memo-26) Avail: CFSTI

An examination is made of some current types of aircraft windshield materials that reduce the amount of external light available to the pilot. The relevant technical literature is surveyed to find what effects this light reduction could have on pilots' vision. From this survey, it is concluded that any tinting is undesirable, and appropriate recommendations are made for the spectral-transmissive properties of windshields and other windows used by flight crew. Auxiliary light-reducing devices (visors, sunglasses) are also discussed. Author

N70-37533*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MDA EXTERNAL MOBILITY AIDS Simulation Test Report
12 Sep. 1969 34 p
(NASA-TM-X-53894; MSFC-R-ME-IN-68-17) Avail: CFSTI CSCL 05E

A neutral buoyancy simulation for evaluating the multiple docking adapter (MDA) external mobility aids is described. The over-all objective of this test was to perform a human factors evaluation of the complete MDA external handrail system. Subjective and objective data obtained from the test subjects indicated that the handrail system was usable. However, additional handrails in several strategically located areas, especially around the conical section, would greatly aid an astronaut in making the necessary translations. All docking ports and scientific airlocks could be reached using the handrails, and work could be performed at these areas with the aid of tethers. Author

N70-37583*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
INTERNAL MOBILITY AIDS EVALUATION Simulation Test Report
12 Sep. 1969 150 p

(NASA-TM-X-53895; MSFC-R-ME-IN-68-18) Avail: CFSTI CSCL 05E

The methods and procedures used in evaluating four internal mobility aid concepts for use in the Multiple Docking Adapter (MDA) are presented. The tests were conducted to determine which of the four concepts is best suited to: (1) translate from any docking port to the structural transition section control panel and windows, (2) stabilize and perform experiments at forward and aft windows, (3) transfer boxes of various sizes from one location in the MDA to another, and (4) translate from any point in the MDA to any other point. Evaluations were made for both shirtsleeve and vented pressure suit operations and the tests were conducted in a 25-foot diameter neutral buoyancy tank. Author

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N70-36208# Princeton Univ., N.J. Dept. of Chemistry.
CHEMICAL ELECTRONIC STRUCTURE THEORY Final Summary Scientific Report
Leland C. Allen 1 Apr. 1970 9 p refs
(Contract AF 49(638)-1625)
(AD-705223; AFOSR-70-1054TR) CSCL 7/4

A brief summary of the authors research is given. The research included three areas: The elucidation of important chemical force laws or rules which can then be applied, quantitatively or qualitatively, to specific large molecules of chemical interest; The development to find out exactly where various existing semi-empirical schemes break down; The development of a systematic analysis of ab initio wavefunctions to assay the chemical information content in their millions of molecular integrals, thereby attempting to greatly reduce the complexity and computation time required. TAB

N70-36209# Naval Ship Research and Development Center, Annapolis, Md.
FACTORS AFFECTING COMBUSTION OF ORGANIC MATERIALS IN HIGH PRESSURE ENVIRONMENTS: SPRAY IGNITION OF ALIPHATIC HYDROCARBONS, 1
Samuel H. Brown, Jr. Apr. 1970 26 p refs
(AD-704503; NSRDL/A-8-362) Avail: CFSTI CSCL 21/2

Samples of n-hexane, n-hexadecane, and squalane were used in initial studies of factors affecting combustion of aliphatic hydrocarbons in a high-pressure injection system. The factors considered were temperature, sample size, pressure, catalytic effects, and chemical structure. Ignition delay as a function of these factors was studied. Information on spontaneous ignition (self-ignition) temperatures also is presented. Ignition delay as a function of temperature was found to be the most significant measurement. Relative activation energies were calculated from the data by the Arrhenius Theory of Reaction Rates. Reactant sample size was found to affect the ignition delay at specified pressures and temperature. Increasing the sample injection pressure and leaving the reactor tube pressure constant decreased the ignition delay under the condition studied. It was shown that for these aliphatic hydrocarbons, ignition delay increased as their molecular weight increased. Author (TAB)

N70-36233# Naval Air Development Center, Johnsville, Pa. Aerospace Medical Research Dept.
RAPID LIQUID CHROMOTOGRAPHY OF NUCLEOTIDES. THE SEPARATION OF PICOMOLE AMOUNTS OF Pi 32, AMP, ADP, AND ATP
Herman W. Shmukler 30 Dec. 1969 21 p refs
(AD-702744; NADC-MR-6919) Avail: CFSTI CSCL 7/4

By means of high pressure pellicular anion exchange chromatography picomole amounts of 32Pi, AMP, ADP and ATP were separated in 25 minutes. The method uses a linear concentration gradient (between 0.01 M-0.74 M in 30 minutes) formed from a buffer containing 0.25 M KH2PO4 and 2.20 M KC2. The flow-rate was 24 ml per hour and the operating temperature was 70C. Author (TAB)

N70-36248# AeroChem Research Labs., Inc., Princeton, N.J.
CONTRIBUTIONS TO THE THEORY OF INTERFACIAL RATE PROCESSES IN FLOW SYSTEMS Final Report, 11 Dec. 1965 – 10 Dec. 1969
Daniel E. Rosner Feb. 1970 18 p
(Contract AF-49(638)-1654)
(AD-704618; AeroChem-TP-234; AFOSR-70-0807TR) Avail: CFSTI CSCL 21/2

The present results have been aimed at increasing our theoretical understanding of simultaneous convection-diffusion-reaction phenomena, with the results recapitulated (via abstracts) in the present summary report. Topics treated include the oxidation and ablation of solids, evaporation and combustion of droplets, particle dissolution, rotating disk reactors, transpiration cooling and nucleation in gas jets and boundary layers. A chronological list is provided of the 12 publications and 26 verbal presentations arising from the program. Author (TAB)

N70-36251# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOLUBILITY OF WATER IN FREONS
A. K. Chernyshev 20 Feb. 1970 7 p refs Transl. into ENGLISH from Kholodiln. Tekhn. (Moscow), v. 46, no. 1, 1969 p 62
(AD-703886; FTD-HT-23-73-70) Avail: CFSTI CSCL 7/4

A nomogram was constructed for a rapid and accurate determination of the solubility of H2Q in Freons as a function of temperature. TAB

N70-36257# Chemical Systems, Inc., Santa Ana, Calif.
POLYHEDRONISM VERSUS ICOSAHEDRONISM
Robert E. Williams 16 Mar. 1970 15 p refs
(Contract N00014-70-C-0109)
(AD-704811; TR-1) Avail: CFSTI CSCL 7/2

It is possible to consider in a simplistic manner all of the known carboranes and boranes to have been structurally derived from the series of polyhedra which characterizes the closo-carboranes rather than primarily fragments of icosahedral surfaces. The absence of selected boranes may be explained via our treatment and non-icosahedral structures are predicted for a number of C4BnH(n+4) nido-carboranes. Author (TAB)

N70-36259# Naval Postgraduate School, Monterey, Calif.
SCATTERING S-WAVE ELECTRONS OFF ATOMIC HYDROGEN
Robert Thomas Elsberry (M.S. Thesis) Jun. 1969 39 p refs
(AD-705102) Avail: CFSTI CSCL 7/4

The Kohn variational method of calculating scattering phase shifts has been examined previously, and calculations of the phase shifts of S-wave electrons on atomic hydrogen done, by Schwartz. The paper presents the results of using a trial function somewhat simpler than Schwartzs and compares the two sets of results. In addition this paper presents and compares the results of two different normalizations of the variational principle and gives a somewhat more detailed development of the variational principle used than in most previous papers. Author (TAB)

N70-36314# Ohio State Univ. Research Foundation, Columbus.
HIGH TEMPERATURE ELECTROCHEMICAL RESEARCH IN METALLURGY

W. M. Boostein, R. A. Rapp, G. R. St. Pierre Apr. 1970 32 p refs
(Contract F33615-70-C-1103; ARPA Order 1466)
(AD-705217) Avail: CFSTI CSCL 7/4

The following five areas of research are discussed: A device for the control of oxygen activities in gases; A study of characteristics of coulometric pumping and the control of its rate into high temperature gases; The coulometric control of oxygen in liquid metals; Kinetic study of oxygen absorption by molten iron and iron alloys; and The design and testing of an electrocatalytic afterburner for automobile exhaust emissions. Author (TAB)

N70-36336# Naval Air Development Center, Johnsville, Pa. Aerospace Medical Research Dept.
THE PURIFICATION OF KH2PO4 FOR USE AS A CARRIER BUFFER IN ULTRA-SENSITIVE LIQUID CHROMATOGRAPHY
Herman W. Shmukler 30 Dec. 1969 17 p refs
(AD-702743; NADC-MR-6910) Avail: CFSTI CSCL 7/4

Buffers prepared from reagent grade KH2PO4 contain UV absorbing impurities that interfere with ultra sensitive liquid chromatographic detectors. These impurities were removed by passage over Dowex 1-X8 (phosphate) columns. Author (TAB)

N70-36348# Naval Postgraduate School, Monterey, Calif.
ELECTRON PROGRAMAGNETIC RESONANCE STUDY OF COPPER HALIDE TETRAZOLE COMPLEXES AND THE FREE RADICALS IN IRRADIATED STRONTIUM ACETATE HEMIHYDRATE
Robert Gary Gisch (M.S. Thesis) Jun. 1969 98 p refs
(AD-704508) Avail: CFSTI CSCL 7/4

An EPR study of copper halide tetrazole complexes and X-irradiated strontium acetate hemihydrate has been made. The powder spectra of some of the tetrazole complexes exhibited temperature dependent narrowing and broadening. The one-electron population of the copper d orbital involved in bonding to 2-methyl-5-amino tetrazole has been found to be 0.56 and 0.47, respectively for the chloride and bromide complexes. The g values for these two complexes are consistent with the proposed planar polymeric structure for 2-substituted tetrazole-copper complexes. The species present in single crystals of strontium acetate hemihydrate irradiated and observed at liquid nitrogen temperature to -100C has a spectrum of four lines of 1:3:3:1 intensity ratio and a CH3- 11.0 gauss. Molecular orbital calculations using the CNDO approximation were performed and possible fragments responsible for these spectra are suggested. Author (TAB)

N70-36363# Pennsylvania Univ., Philadelphia. Dept. of Chemistry.
HIGH PRESSURE INORGANIC AND ORGANOMETALLIC SYNTHESES Final Report, 1 Feb. 1965 - 31 Aug. 1969
Alan G. Mac Diarmid, Arnulf P. Hagen, and Philip M. Boudy 30 Sep. 1969 13 p refs
(Contract AF 49(638)-1519)
(AD-700784; AFOSR-70-0271 TR) Avail: CFSTI CSCL 7/2

A summary of the authors publications and results are given on the use of high pressures in synthesizing compounds such as F3SiCo(CO)4, OPF3, SPF3, etc. Syntheses of compounds such as 2(Bu4N)(+), (SiF4Cl2)(-2), and Cl2Si(2,2-dipyridyl)2 have also been carried out. Physical, spectroscopic, structural and chemical properties of the compounds have been investigated in detail and are described. Author (TAB)

N70-36374# Stanford Research Inst., Menlo Park, Calif.
ENERGY TRANSFER REACTIONS INVOLVING METASTABLE SPECIES OF ATMOSPHERIC INTEREST Final Report, 1 Feb. 1969 - 31 Jan. 1970
Graham Black 30 Jan. 1970 17 p refs
(Contract DAHC04-69-C-0048)
(AD-701911; AROD-8279-2-C) Avail: CFSTI CSCL 4/1

Energy transfer reactions of electronically excited atomic and diatomic species were studied. The excited species were created by vacuum ultraviolet irradiation of simple molecules, with image-tube spectrographs and filtered photomultipliers being utilized to detect and monitor emission features. Quantum yields for excited states were deduced from absolute intensity measurements. A pulsed photolysis-signal integration system was used to determine absolute rate coefficients for energy transfer reactions of O(singlet S), N2(A triplet Sigma(u)(+), and N(doublet D). O(singlet D) and CO(A singlet Pi) were also studied. Resonance fluorescence scattering was used to measure O(triplet P), CO(X singlet Sigma(+)), and NO(X doublet Pi(r)). Author (TAB)

N70-36424# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF THE ELECTRON STRUCTURE OF THE FERRICINE ION
Yu. S. Karimov et al 13 Oct. 1969 17 p refs Transl. into ENGLISH from Radiospektroskopicheskie i Kvantovokhimicheskie Metody v Strukt. Issled. (USSR), 1967 p 128-133
(AD-700345; FTD-MT-24-237-69) Avail: CFSTI CSCL 7/4

The article investigates the electron structure of the ferrocene ion in ferrocenium tetrafluoroborate by the methods of electron and nuclear resonance. TAB

N70-36433# Eidgenossische Technische Hochscule, Zurich (Switzerland).
CONTRIBUTION TO KNOWLEDGE ON CATALYTIC DEHYDRATION OF HETEROCYCLIC NITROGEN [BEITRAG ZUR KENNTNIS DER KATALYTISCHEN DEHYDRIERUNG VON STICKSTOFF-HETEROCYCLEN]
Richard Sidler (Ph.D. Thesis) 1969 91 p refs In GERMAN
(Diss-4091) Avail: CFSTI

Catalytic dehydration of piperidine, pyrrolidine, and piperazine established that the presence of hydrogen improved the stability of the catalyst; dehydration resulted in Schiff bases as intermediate products which quickly polymerized. This reaction contaminated the contact surface and decreased catalyst activity. Substituents on reactive molecular spaces eliminated polymerization of the intermediate product almost completely. Depolarization velocity was parallel to proton density at the contact which in turn depended on the water solubility of the catalyst material. A palladium silver alloy catalyst dissolved three times more hydrogen than a pure palladium catalyst. Transl. by G.G.

N70-36451# Naval Postgraduate School, Monterey, Calif.
INFRARED SPECTRUM ANALYSIS OF THE HYDROCHLORIC ACID-WATER-CARBON TETRACHLORIDE SYSTEM
George Masaru Fukumoto (M.S. Thesis) Jun. 1969 31 p refs
(AD-705073) Avail: CFSTI CSCL 7/4

The infrared vibrational-rotational spectra of hydrochloric acid and water dissolved together in carbon tetrachloride were obtained and compared with the spectra of hydrochloric acid in carbon tetrachloride and of water in carbon tetrachloride separately. Spectra of extremely dilute solutions of the two solutes in the non-polar solvent were analyzed for nature and extent of solvent-solute interaction. Dilution behavior was investigated by the use of the Beer-Lambert Law. Possible resulting species were also investigated. Author (TAB)

N70-36460# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
VACUUM-THERMAL SYNTHESIS OF METANIOBATES AND METATANTALATES ALKALI METALS
S. A. Kutolin et al 26 Feb. 1970 12 p refs Transl. into

ENGLISH from Prom. Khim. Reaktivov Osobo Chist. Veshchestv (USSR), v. 16, no. 10, 1967 p 46–53
(AD-704005; FTD-HT-23-131-70) Avail: CFSTI CSCL 7/2

Metaniobates and metatantalates of the alkali metals were synthesized by sintering lithium, sodium, potassium, rubidium, and cesium carbonates with niobium and tantalum pentoxides in the temperature interval from 650 to 850 C for 1 to 3.5 hr., at a residual pressure of 1 mm Hg. The charge, ground to 200 mesh, and with a molecular ratio of 1 to 1, weighed 20 gr. Experiments were carried out in parallel in an electric vacuum furnace and in air in a muffle furnace. The degree of completion of the reaction was determined by weight loss and from chemical and x-ray phase analyses. The content of niobium and tantalum pentoxides was determined by the weight method. X-ray analysis shows that the intensity of the lines belonging to the starting components falls with an increase in the temperature and the holding time. In products synthesized in vacuum, the lines disappear completely. It follows that the degree of completion of the reaction is higher in vacuum than in air. It is recommended that the synthesis be carried out at a temperature below the melting temperature of both the starting and final compounds. The yield of product did not differ by more than 2 percent from the theoretical. TAB

N70-36478 National Lending Library for Science and Technology, Boston Spa (England).
NORMAL FLAME SPEEDS OF RICH METHANE OXYGEN AND METHANE AIR MIXTURES
N. V. Lavrov et al 24 Jun. 1970 5 p refs Transl. into ENGLISH from Gazov. Prom. (USSR), no. 6, 1968 p 42–43
(NLL-M-9215-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupon

Normal flame speed determinations for rich gas mixtures at different preheating temperatures (20 to 1000 C) and atmospheric pressure are presented. A burner with interchangeable 6, 8, 10, and 12 mm nozzles was used with methane/air mixtures at temperatures not exceeding 600 C. A ceramic 540 mm capillary burner was used for methane/oxygen mixtures with high normal flame speed values to combat flashback within the burner. Quantitative measurements of gas supplied and flow rate were made on orifice plates or rotameters. The heated gas stream passing out of the burner was analyzed in the high temperature preheating tests. Normal flame speed values as a function of CH4 content at different preheating temperatures were determined. The flame cone and the heated gas flowing from the jet were studied by Schlieren photography. It is concluded that the normal flame speed depends on the methane content of the mixture and the preheating temperature. J.M.

N70-36485# Georgetown Univ., Washington, D.C.
COMPILATION OF ONE-DIMENSIONAL ATOM DIATOM TRANSLATIONAL-VIBRATIONAL TRANSITION PROBABILITIES
William L. Clinton, Christine M. Cosgrove, and George A. Henderson 1 Dec. 1969 156 p refs Sponsored in part by ARPA
(Contract NBS-CST-372; Proj. Defender)
(AD-705109) Avail: CFSTI CSCL 7/4

In recent years a great many calculations on vibrational energy transfer have appeared in the literature. Since most of the calculations have been done for a one-dimensional atom-diatom exponential interaction, a large amount of data has accumulated that is easy to categorize. The present compilation, therefore, is limited to these calculations. Specifically, included are only those results that refer to the system A---B - C with an exponential interaction between A and B and a harmonic interaction between B and C. This problem can be completely specified with the incident relative energy of A and B - C, a potential parameter, and a single mass parameter defined in the text. Collisional transition probabilities are tabulated as a function of these three parameters and the oscillator quantum numbers. Author (TAB)

N70-36491 National Lending Library for Science and Technology, Boston Spa (England).
USE OF A METHOD OF ELECTRODIALYSIS WITH AN ANION EXCHANGE MEMBRANE FOR INVESTIGATING THE STAGE OF BORON IN SOLUTIONS
A. L. Grekovich et al 14 Mar. 1970 13 p refs Transl. into ENGLISH from Zh. Neorg. Khim. (Moscow), v. 15, no. 1, 1970 p 182–186
(NLL-Risley-Tran-1918-(9091.9F) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The use of electrodialysis with an anion exchange membrane in the investigation of aqueous borate solutions shows that assumptions about the ionic forms in solution can be made from transfer of ions through the membrane. Investigations of borolactate and borooxalate solutions by the electrodialysis method makes it possible to establish the existence, in these solutions, complex anions. Author

N70-36504# National Engineering Lab., Glasgow (Scotland). Properties of Fluids Div.
THE THERMAL CONDUCTIVITY OF BINARY LIQUID MIXTURES: A SURVEY TO 1968
D. T. Jamieson and J. S. Tudhope Oct. 1969 68 p refs
(NEL-435) Copyright. Avail: CFSTI

This survey reviews the literature relating to the thermal conductivity of about 300 binary liquid systems. The results are tabulated and an assessment of accuracy is given. A method for interpolation and/or extrapolation of data is also included. Author

N70-36507# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
EQUILIBRIUM CRITICAL PHENOMENA IN FLUIDS AND MIXTURES: A COMPREHENSIVE BIBLIOGRAPHY WITH KEY-WORD DESCRIPTORS
Stella Michaels, Melville S. Green, and Sigurd Y. Larsen Jun. 1970 235 p refs
(NBS-SP-327) Avail: SOD $4.00

This bibliography of 1088 citations comprehensively covers relevant research conducted throughout the world between January 1, 1950, and December 31, 1967. Each entry is characterized by specific key word descriptors, of which there are approximately 1500, and is indexed both by subject and by author. In the case of foreign language publications, effort was made to find translations which are also cited. Author

N70-36511# Aerospace Corp., El Segundo, Calif. Lab. Operations.
SIMULTANEOUS DIFFERENTIAL THERMAL-MASS SPECTROMETER ANALYSES OF NITRATE SALTS OF MONOMETHYLHYDRAZINE AND METHYLAMINE, MARCH–JUNE 1969
Peter Breisacher, Hideyo H. Takimoto, Genevieve C. Denault, and William A. Hicks 1 Jan. 1970 22 p refs
(Contract F04701-69-C-0066)
(AD-704591; TR-0066(5210)-6; SAMSO-TR-70-117) Avail: CFSTI CSCL 7/3

Simultaneous differential thermal-mass spectrometer analyses of low-pressure decompositions of the nitrate salts of monomethylhydrazine and methylamine were investigated. These products are commonly found as intermediates in the incomplete combustion of N2O4-monomethylhydrazine bipropellant motors. Compositions of the evolved species were correlated with differential thermograms over the entire temperature range until decomposition was complete. A total of 11 identified compounds were tabulated with respect to their concentration ratios. Author (TAB)

N70-36522# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF THE THERMAL OXIDATION DEGRADATION OF POLYTRIFLUOROETHYLENE IR-SPECTROSCOPY
Ts. S. Dunaevskaya et al 11 Sep. 1969 9 p refs Transl. into ENGLISH from Vysokomol. Soedin., Ser. B (USSR), v. 10, no. 11, 1968 p 868–869
(AD-700339; FTD-HT-23-431-69) Avail: CFSTI CSCL 7/3

The IR-spectroscopy method showed the formation of aldehyde groups during thermal aging of polytrifluoroethylene. A hypothesis was derived regarding the mechanism of thermal oxidation degradation. Measurement of relative viscosity of polytrifluoroethylene solutions after aging in vacuum indicates the formation of cross links of the polymer chains. Author (TAB)

N70-36531# Eidgenossische Technische Hochschule, Zurich (Switzerland).
ON THE OXOSYNTHESIS OF PROPIONE ALDEHYDE IN A THIN LAYER REACTOR [UEBER DIE OXOSYNTHESE VON PROPIONALDEHYD IM DUENNSCHICHTREAKTOR]
Roland Fehr (Ph.D. Thesis) 1969 78 p refs In GERMAN
(Diss-4290) Avail: CFSTI

The oxosynthesis, a hydroformylation of olefins with carbon monoxide and hydrogen in the presence of dissolved cobalt compounds, is used to obtain propione aldehyde in a thin layer reactor. Syntheses with dicobalt octa-carbonyl gave very high aldehyde outputs - partly in the form of the trimeric para-propion aldehyde - of more than 95%. Trimerization of propion aldehyde to para-propione aldehyde is catalyzed by cobalt hydrogen carbonyl and takes place outside of the reactor at low temperatures; the latter reaction can be suppressed by dilution with solvents. Transl. by G.G.

N70-36537# Eidenossische Technische Hochscule, Zurich (Switzerland).
SYNTHEISS OF FERRIC CHROMIUM [SYNTHESE VON FERRICHROM]
Bruno Maurer (Ph.D. Thesis) 1969 65 p refs In GERMAN
(Diss-4328) Avail: CFSTI

Amino acid delta-nitro-L-norvaline was produced by enzymatic deacetylation with acylase from pig kidneys in an optical pure form. Prolonged heating with water gave 5-oximino-L-proline. Reaction of delta-nitro-L-norvaline with glycine produced a protected hexapeptide. The cyclic hexapeptide was transformed into the corresponding iron(3)-trihydroxamate complex which exhibited the same chemical, physical, and biological properties as the natural ferric chromium. Transl. by G.G.

N70-36538# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SERIES IN THE PHYSICAL AND TECHNICAL SCIENCES
V. P. Bubnov et al 30 Jan. 1970 40 p refs Transl. into ENGLISH from Vestsi Akad. Navuk Belarusk SSR: Ser. Fiz.-Tekhn. Navuk (Minsk), no. 1, 1966 p 15–33
(AD-703768; FTD-HT-23-307-69) Avail: CFSTI CSCL 7/4

Contents: Thermodynamic analysis of cycles employing chemically reacting gases as the working fluid; Calculation of the viscosity of equilibrium dissociating nitrogen tetroxide; and Thermal conductivity of equilibrium dissociating nitrogen tetroxide. TAB

N70-36543# Stevens Inst. of Tech., Hoboken, N.J. Dept. of Chemistry and Chemical Engineering.
KINETICS OF AUTOXIDATION OF ATACTIC POLYPROPYLENE BY INFRARED SPECTROSCOPY
B. R. Jadrnicek, S. S. Stivala, and Leo Reich Mar. 1970 31 p refs
(Contract N00014-68-A-0131)
(AD-704819; TR-16) Avail: CFSTI CSCL 7/4

The autoxidation of a film of atactic polypropylene was studied by means of infrared spectroscopy. Reaction temperatures varied from 110 to 135C and oxygen concentrations from 5 to 100% by volume. A general reaction scheme previously reported for the autoxidation of polyolefins was utilized for atactic polypropylene. Various results obtained for this polymer were compared with those previously reported for isotactic polypropylene. Author (TAB)

N70-36554# Eidgenossische Technische Hochschule, Zurich (Switzerland).
ON THE THERMODYNAMIC OF ION ASSOCIATION IN AQUEOUS SOLUTION [ZUR THERMODYNAMIK DER IONENASSOZIATION IN WAESSERIGER LOESUNG]
Theordor Friedrich Landis (Ph.D. Thesis) 1969 91 p refs In GERMAN
(Diss-4329) Avail: CFSTI

An empirical method is used to analyze the effective dielectric constants and their temperature coefficients in thermodynamic functions. Compared are the acidity constants pK of two acids which differ mainly in their ion charge from each other. Results show that if both acid groups 1 and 2 are identical in regard to bond energy for the acid proton, their acidity constant difference measures the energy that develops during transport of positive H from the ion charge over distance. Both ion charges of organic acids effect each other much more because they rest on an organic carrier. As carrier volume increases for the same distance, the dielectric constant decreases. Transl. by G.G.

N70-36557# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
DIRECT POTENTIOMETRIC DETERMINATION OF THORIUM IN ORGANIC SAMPLES AND STATISTICAL ESTIMATION OF THE RESULTS, PART 2 [TORIO: DETERMINAZIONE POTENZIOMETRICA DIRETTA SU CAMPIONI ORGANICI. STIMA STATISTICA DEI RISULTATI OTTENUTI, PARTE 2]
V. Altamura, V. Pompei, and F. Siciliano 1970 21 p refs In ITALIAN; ENGLISH summary
(RT/CHI(70)4-Pt-2) Avail: CFSTI

A linear method using statistics of linear relations and regression analysis for determining throium concentration is presented. It is shown that the method is free form systematic errors proportional to the concentration of thorium in the concentration range being examined. For these concentration ranges the optimum concentration is established for future samplings, and the variation coefficient would be about one percent. Author

N70-36571# South Carolina Univ., Columbia. Dept. of Chemistry.
THE SOLVOLYTIC REACTIVITY OF PI-COMPLEXED COMPOUNDS Final Status Report, 1 Sep. 1965–31 Jan. 1970
Robert S. Bly, Jr. 31 Mar. 1970 30 p refs
(Grant AF-AFOSR-991-67)
(AD-706266; AFOSR-70-1084TR) Avail: CFSTI CSCL 7/4

The solvolytic reactivity of some pi-complexes was examined using as ligands organic molecules which were thought to undergo solvolysis with extensive pi-electron delocalization. Two types of complexes were prepared and their solvolytic reactions examined, namely chromium tricarbonyl-complexed beta-arylalkyl derivatives and 7-substituted norbornadiene chromium tetracarbonyls. Author (TAB)

N70-36621# Ballistic Research Labs., Aberdeen Proving Ground, Md. Signature and Propagation Lab.
NEGATIVE ION REACTIONS IN NO-H2O MIXTURES

Lawrence J. Puckett and William C. Lineberger Dec. 1969 26 p refs
(AD-702227; BRL-1483) Avail: CFSTI CSCL 4/1

A stationary afterglow system has been utilized to determine rate constants for thermal energy negative ion-molecule reactions in photoionized NO-H2O mixtures. When the decay of the plasma is controlled by ambipolar diffusion of positive and negative ions quantitative determination of rate constants is shown to be feasible. The plasma transition from electron-positive ion ambipolar diffusive domination of the transport loss processes to domination by positive ion-negative ion ambipolar diffusion is explained by a model which includes the effects of negative ion trapping. Prominant negative ions in the afterglow include NO2(-), its hydrates, and clusters involving HNO2. Steady glows in NO-H2O-O2 mixtures revealed that NO3(-) and the impurity HCO3(-) also formed multiple hydrates and clustered with HNO2. These results indicate that the terminal negative ions in the D-region of the ionosphere will likely be hydrated. Author (TAB)

N70-38625# Naval Postgraduate School, Monterey, Calif.
THE PHOTO-INDUCED REACTION OF BROMINE WITH PHENYLCYCLOPROPANE
William Charles Nierman (M.S. Thesis) Jun. 1969 43 p refs
(AD-705099) Avail: CFSTI CSCL 7/3

Prior studies on the mechanism of the cleavage of cyclopropane and substituted cyclopropane compounds are reviewed and discussed. The rate law for the photolytic reaction of bromine with phenylcyclopropane in concentrations of about 0.02 molar in carbon tetrachloride was determined to be first order in phenylcyclopropane, and half order in bromine and in light intensity. The photo-induced reaction of bromine with a fifteen molar solution of phenylcyclopropane gave 1,1,2,3-tetrabromo-1-phenylpropane as the major product. When this reaction was run using a 1.5 molar solution of bromine and phenylcyclopropane in carbon tetrachloride the product was a mixture of 1,3-dibromo-1-phenylpropane and 1,2-dibromo-1-phenylpropane with the 1,2 isomer predominating. The mechanism of this reaction is discussed. Author (TAB)

N70-38656*# Massachusetts Inst. of Tech., Cambridge.
MOLECULAR BEAMS IN CHEMISTRY
J. E. Jordon, E. A. Mason (Brown Univ.), and I. Amdur [1969] 138 p refs Submitted for publication Sponsored in part by NASA and NSF Prepared in cooperation with Brown Univ.
(Contract N00014-67-A-0204-004)
(NASA-CR-112679; AD-705519; TR-10(26)) Avail: CFSTI CSCL 7/4

The broad field of molecular beam research is related to chemical problems. Potential energies for complex molecular systems are considered and the anisotropies of such potentials are discussed. Inelastic scattering, particularly rotational and vibrational excitation, and reactive scattering are investigated. Ion-molecule research by molecular beam methods is also discussed. R.B.

N70-38924# Imperial Coll. of Science and Technology, London (England). Thermofluids Section.
HEAT AND MASS TRANSFER IN RECIRCULATING FLOWS. LECTURE 8: APPLICATION TO FLOWS INVOLVING COMBUSTION
W. M. Pun Dec. 1968 33 p refs Lecture presented at Post-Experience Course, London, 17-19 Dec. 1968
(EF/TN/A/12) Avail: CFSTI

The application of the solution procedures to flows with large density variations, which are generated by chemical reaction is demonstrated, and results from flows involving combustion are presented. The following flow geometries are discussed: cylindrical-polar, spherical-polar, and Cartesian. The simplifying assumptions used in developing the reaction model are given. F.O.S.

N70-38932*# Brigham Young Univ., Provo, Utah.
STUDIES OF REACTION GEOMETRY IN OXIDATION AND REDUCTION OF THE ALKALINE SILVER ELECTRODE QUARTERLY REPORT
Eliot A. Butler and Angus U. Blackham 15 Aug. 1970 25 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952268)
(NASA-CR-112868; QR-9) Avail: CFSTI CSCL 07D

Samples of silver wire, silver sheet and sintered silver electrode were examined at various stages of anodization with a scanning electron microscope. The micrographs show the development of argentous oxide mounds which increase in diameter up to approximately one micron. During a constant current oxidation, the number of mounds per unit area increases until at the end of the first potential plateau they cover approximately 80% of the surface. Beyond this point along the second potential plateau argentic oxide structures of different geometry are observed to grow on the argentous oxide mounds. These observations on silver wire and sheet electrodes are compared with those on sintered silver electrodes. Potential fluctuations or oscillations were observed in constant current oxidations of model pore electrodes. The use of two Luggin capillaries to sense the potentials at the mouth of the pore and at a point midway up the pore have shown some abrupt potential fluctuations early in the constant current oxidation. Author

N70-38955# Lockheed Missiles and Space Co., Palo Alto, Calif.
RADIATIVITY OF HEATED CARBON DIOXIDE GAS IN THE 2100-2500/cm DOMAIN IN THE ABSENCE OF THERMODYNAMIC EQUILIBRIUM
L. N. Kopylova et al 1970 8 p refs Transl. into ENGLISH from Zh. Prikl. Spektrosk. (USSR), v. 12, no. 5, 1970 p 811-818
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Analysed is the influence of temperature on the radiativity of heated carbon dioxide gas in the infrared range of the spectrum in the absence of a thermodynamic equilibrium. A line by line computation is carried out for successive determinations of centers of the vibrational bands, the centers of rotational lines, their intensities and the monochromatic absorption coefficient which assures the maximum value of the absorption function. Obtained values for the absorption function of carbon dioxide at 1200 K and at 1 atm are presented in tables. G.G.

N70-38988# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.
MIXING AND CHEMICAL REACTION IN STEADY CONFINED TURBULENT FLAMES
D. B. Spalding Jun. 1970 23 p refs Presented at the 13th Symp. on Combust., Utah, Aug. 1970 Revised
(CCK/TN/A/4-Rev) Avail: CFSTI

A calculation procedure was developed for solving the partial parabolic differential equation of turbulent flame spread. This procedure was applied to the spread of flame behind a baffle in a plane-walled duct, with two distinct models for the kinetics of the reaction. In the first model, the time-mean reaction rate is related to the time-mean concentrations and temperature at the point in question by a bi-molecular Arrhenius expression. In the second model, the local reaction rate is taken to depend on the rate of break-up of the eddies by the action of turbulence; and to be controlled by this rate when it is low. The second model fits the experimental data better than the first. A third model of turbulent combustion is also described. It involves the calculation by the magnitude of the fluctuating concentrations, and correctly predicts the main features of turbulent diffusion flames. One of its implications is a finite reaction-zone thickness, even though there is no chemical-kinetic resistance. Author

N70-38989# Department of Supply, Melbourne (Australia). Aeronautical Research Labs.

THE SOLUBILITY OF NITROGEN IN SOLID CHROMIUM
T. Mills Feb. 1970 17 p refs
(ARL/Met-81) Avail: CFSTI

The solubility of nitrogen in chromium was determined by previously showing discrepancies at 1300 C. All tests were conducted at a constant temperature in nitrogen at various pressures. Saturated solubility was determined by observing deviations from Sievert's law, and by quenching and analyzing the equilibrium of nitrogen in chromium specimens surrounded by a chromium-chromium nitride mixture. Using the direct gravimetric technique, an attempt was made to remove these uncertainties. Results indicate agreement with the observations made using Sievert's law. E.H.W.

N70-36982# Eidgenossische Technische Hochschule, Zurich (Switzerland).
INFRARED SPECTROSCOPIC INVESTIGATIONS OF IRON CHLORIDES
Raymond Frey (Ph.D. Thesis) 1969 87 p refs
(Diss-4391) Avail: CFSTI

The molecular and crystal structure of iron chlorides were studied with matrix spectroscopy. The geometry of the chlorides are given, and the thermodynamic data from the observed spectra are given. F.O.S.

N70-36985# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
QUANTITATIVE ANALYSIS OF STRONTIUM 90 IN RADIOACTIVE WASTES BY MEANS OF THENOYLTRIFLUOROACETONE [DOSAGE DU STRONTIUM 90 DANS LES EFFLUENTS RADIOACTIFS PAR LE THENOYLTRIFLUOROACETONE]
Gilbert Testemale and Jean-Louis Loredde Mar. 1970 25 p refs In FRENCH; ENGLISH summary
(CEA-R-3908) Avail: CFSTI

A simple method for measuring quantities of Sr-90 has been perfected. It consists of a double extraction by means of thenoyltrifluoroacetone and tributylphosphate in carbon tetrachloride followed by elimination of yttrium 90 by means of thenoyltrifluoroacetone in benzene. The yield is about 97 per cent. Author (ESRO)

N70-36994# Commissariat a l'Energie Atomique, Bruyeres-le-Chatel (France).
RARE-EARTH EXTRACTION USING DI-2-ETHYL HEXYLPHOSPHORIC ACID [ETUDE DE L'EXTRACTION DES TERRES RARES PAR L'ACIDE DI-2-ETHYL HEXYLPHOSPHORIQUE]
Simone Gusmini and Rene Nonnenmacher May 1970 33 p refs In FRENCH; ENGLISH summary
(CEA-R-4004) Avail: CFSTI

The extraction of the rare-earths with di-2-ethyl hexylphosphoric acid (D2EHPA) was studied and the influences of the aqueous phase (acidity and nature), agitation time, concentration of the D2EHPA in the organic phase, and the nature of the diluant were examined. The nature of the acid had only a small influence. The kinetics of the reaction are rapid and an ion-association phenomenon occurs at high acid molarities. Author (ESRO)

N70-36999# Commissariat a l'Energie Atomique, Bruyeres-l2-Chatel (France).
POSSIBILITIES OF GAS-PHASE RADIO-CHROMATOGRAPHY: APPLICATION TO PERMANENT GAS ANALYSIS [POSSIBILITIES DE LA RADIOCHROMATOGRAPHIE EN PHASE GAZEUSE: APPLICATION A L'ANALYSE DES GAZ PERMANENTS]
Marie-Claire Dupuis, Guy Charrier, Claude Alba, and Daniel Massimino Jan. 1970 32 p refs In FRENCH; ENGLISH summary
(CEA-R-3879) Avail: CFSTI

The gas-phase radio-chromatography technique was applied to the rapid analysis of permanent gases (H2, O2, N2, A, Kr, Xe, CO, CH4) labelled with radioactive indicators (H-3, A-37, Kr-85, Xe-133). The components of such mixtures can be identified and their concentrations measured in less than two hours, using sample volumes from 0.1 to 10 cu cm. The minimum detectable activity is of the order of 0.0001 microcurie for each radioactive isotope. These studies were concerned with the parameters affecting the responses of ionization chambers and gas flow proportional counters. The method has numerous applications both for the study of chromatographic phenomena under ideal conditions (infinitesimal concentrations made possible by the use of radioactive tracers), and the rapid and accurate radiochemical analysis of radioactive gas mixtures. Author (ESRO)

N70-37000# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
STUDY OF COLLOIDAL MOLYBDENUM BLUE [ETUDE SUR LE BLEU DE MOYLBDENE COLLODAL]
Irene Gratot and Jacqueline Beydon Feb. 1970 19 p refs In FRENCH; ENGLISH summary
(CEA-R-3933) Avail: CFSTI

The conditions for preparing colloidal molybdenum blue by photochemical reduction of the molybdate using formaldehyde were determined, particularly the reagent concentrations and the exposure time to the reducing radiation. By gamma-radiation reduction C-60 or Cs-137, it was possible to obtain a good yield, even for high molybdate concentrations, in contrast to the ultraviolet radiation technique. The colloid was stable at a pH of less than 3. It was not possible to separate Tc-99m by beta recoil from a colloid labeled with Mo-99. Author (ESRO)

N70-37022# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
REACTIONS UF4-ClO2F AND UF6-ClO2F [REACTIONS UF4 - ClO2F ET UF5 - ClO2F]
Raymond Benoit, Ginette Besnard, Olivier Hartmannsenn, Michel Luce, Jacques Mougin et al Feb. 1970 42 p refs In FRENCH; ENGLISH summary
(CEA-R-3983) Avail: CFSTI

The study of the reaction UF4-ClO2F ClO2F between 0 and 100 C by microsublimation, isopiestic methods, IR and UV spectrography, thermogravimetry and X-ray diffraction showed that intermediate steps were possible before the production of UF5. The complete reaction can be schematized by two equations. Author (ESRO)

N70-37038# Argonne National Lab., Ill.
LABORATORY INVESTIGATIONS IN SUPPORT OF FLUID-BED FLUORIDE VOLATILITY PROCESSES. PART 21: FILTRATION OF AEROSOLS FROM PLUTONIUM HEXAFLUORIDE HYDROLYSIS
Robert W. Kessie, Lawrence J. Marek, and Martin J. Steindler Nov. 1969 52 p refs
(Contract W-31-109-eng-38)
(ANL-7612) Avail: CFSTI

The volatility of PuF6, combined with the high toxicity of plutonium, requires that a high degree of cleanup be provided for the off-gas from an enclosure in the event of an accidental release of PuF6 in the enclosure. The concluding phase of a small-scale experimental program on the removal of PuF6 from ventilation air by hydrolysis to a solid aerosol followed by high-efficiency filtration with fiber filters is described. Five significant variables in relation to plutonium penetration of filters were identified in the study. Empirical correlations based on the variables are reported that give the plutonium penetration of the first filter

to within an average error factor of 7 and of the first two filters combined to within an average error factor of 4. The experimental reproducibility appears to be better than that indicated by the correlation error. Loading effects on pressure drop were measured, and an empirical correlation is presented. Electrostatic effects that increase filter penetration were superficially evaluated, both theoretically and experimentally. NSA

N70-37037# Argonne National Lab., Ill.
DETERMINATION OF METALLIC IMPURITIES AT THE PPB-PPM LEVEL IN SODIUM
T. P. Ramachandra and W. A. Hareland Mar. 1970 20 p refs
(Contract W-31-109-eng-38)
(ANL-7668) Avail: CFSTI

A rapid and reliable method was developed for separating and determining 13 trace metals in EBR-2 sodium. Reactor sodium sampled in a high-purity tantalum cup is vacuum-distilled at 320 C in a quartz distillation unit, and the trace metals in the residue are subsequently determined by atomic absorption spectrophotometry. Of 15 metals tested, 13 remained quantitatively in the distillation residue, while zinc and cadmium as well as alkali metals distilled with the sodium. Recovery data are presented. Approximately 2 hr are required to distill 50 g of sodium in the distillation unit. Based on a 50-g sample, the following metals may be determined with a relative precision of + or − 25% at the levels indicated: aluminum, 600 ppb; bismuth, 100 ppb; calcium, 20 ppb; cobalt, 20 ppb; copper, 20 ppb; chromium, 20 ppb; iron, 50 ppb; magnesium, 5 ppb; manganese, 5 ppb; molybdenum, 70 ppb; nickel, 50 ppb; lead, 50 ppb; and tin, 500 ppb. The distillation residue is also suitable for gamma-spectrometric analysis of fission and activation products that do not distill with the sodium. Author (NSA)

N70-37087# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
SIMPLIFIED INSTALLATION FOR THE PREPARATION OF RADIOACTIVE COLLOIDAL GOLD [APPAREILLAGE SIMPLIFIE POUR LA PREPARATION D'OR COLLOIDAL RADIOACTIF]
Roland Carre and Nicole Falconi Mar. 1970 12 p refs In FRENCH; ENGLISH summary
(CEA-R-3949) Avail: CFSTI

A simpler method of preparing colloidal Au-198 without changing its characteristics was investigated. Previous equipment consisted of a large fixed device resulting in a very complicated system of circuits under vacuum. The new one is a mobile unit composed of ordinary glassware such as beakers and erlenmeyers producing solutions of radioactive colloidal gold with usual characteristics. Author (ESRO)

N70-37106*# Bureau of Mines, Pittsburgh, Pa.
INTERSTITIAL COMPOUNDS AS FUEL CELL CATALYSTS: THEIR PREPARATIVE TECHNIQUES AND ELECTROCHEMICAL TESTING
Sayeed Akhtar, C. T. Grein, and D. Bienstock 1970 63 p refs
(NASA Order W-12300)
(NASA-CR-112786; Bull-652) Avail: SOD $0.60

Interstitial compounds of iron, cobalt, and nickel, and their binary and ternary mixtures with silver, gold, palladium, and platinum were prepared and tested as fuel cell catalysts. The first step in the preparation of the interstitial compounds consists of preparing finely divided metals by either the Raney method or by reduction of precipitated hydroxides of the metals. The finely divided reduced metals are then treated with carbon and/or nitrogen-containing gases to prepare their carbides, nitrides, and nitrocarbides. The materials were tested for cathodic activity towards O2 and for anodic activity towards H2, C3H8, NH3, CO, and N2H4 in acid and alkaline electrolytes at 25 to 90 C in half-cell assemblies. Samples of carbided and nitrocarbided 1Ni-1Ag-1Au were about one fifth as active as Pt-black in the reduction of O2 in 35 percent KOH solution, whereas the activities of several interstitial preparations exceeded the activity of Pt-black in the reduction of O2 in 12M KOH containing N2H4. Nitrocarbides of chi-Fe2C, 3Ni-1Au, and 1Ni-3Au were effective catalysts for oxidizing N2H4 in liquid NH3 containing NH4SCN. Corrosion of the catalysts by electrolytes was severe in many cases. Author

N70-37125# California Univ., Berkeley. Lawrence Radiation Lab.
FOAM FRACTIONATION OF RARE-EARTH ELEMENTS
George H. Robertson (Ph.D. Thesis) and Theodore Vermeulen Dec. 1969 138 p refs
(Contract W-7405-eng-48)
(UCRL-19525) Avail: CFSTI

The foam fractionation of rare earth elements Nd, Sm, and Ce by extraction of their EDTA chelates with a cationic surfactant, and the foam fractionation of an anionic surfactant were studied. The objective was to determine the usefulness of the foaming technique in fine separations and to examine quantitatively the properties of transient foaming in producing the separation. The model of "persistent" foaming did not apply to most of the foaming conditions, which were found to favor foam formation, extraction, and fractionation. Therefore, a two-property classification was adopted; the type being determined by the persistence or transience of surface area, and the mode by the constancy or depletion of specific liquid content with foam height or age. In a preliminary study, fixed-height foaming from aqueous solutions of an anionic surfactant (Aerosol 22) was used to evaluate the effect of gas rate on the relative transiency and separation performance. Foaming of Aerosol-22 in a transient regime of gas rates yielded the best enrichments and extraction. Author (NSL)

N70-37127# Commissariat a l'Energie Atomique, Bruyeres-le-Chatel (France).
SEPARATION AND DETERMINATION OF KRYPTON AND XENON BY GAS-PHASE RADIOCHROMATOGRAPHY [SEPARATION ET DOSAGE DE KRYPTON ET DE XENON PAR RADIOCHROMATOGRAPHIE EN PHASE GAZEUSE]
Guy Charrier Mar. 1970 51 p refs In FRENCH; ENGLISH summary
(CEA-R-3889) Avail: CFSTI

The optimum conditions for separating and detecting Kr-85 and Xe-133 by gas-phase chromatography were determined using a small-volume circulation ionization-chamber and the reproducibility and sensitivity were studied in the 0.005 – 100 microcurie range. Fission gases obtained by the outgassing of irradiated uranium were analysed. The method can be applied to the determination of very low burn-ups. Author (ESRO)

N70-37129# Mellon Inst., Pittsburgh, Pa. Radiation Research Labs.
[RADIATION CHEMISTRY AND PHYSICS] Quarterly Report, 1 Jan. – 31 Mar. 1970
10 Apr. 1970 17 p refs *Its* Fundamental Res. No. 6041
(Contract AT(30-1)-2310)
(RRL-2310-296) Avail: CFSTI

Research progress is reported on: radiation chemistry of CFCl3, CF2Cl2, and CF3Cl in dilute aqueous solutions; steady-state ESR measurement of the rate constant for the reaction of H atoms in aqueous solution; reactions of nitriles with aqueous negative e and H; carbon coupling constants in acid radicals; ESR studies of fluorinated silyl radicals; electron trapping in the crystalline state of heterocyclic compounds with large dipole moments; radiation chemistry of viscous hydrocarbons; electric field effects on the radiolysis of liquid hydrocarbons; electron reactions in the gas phase; and electrolyte and micellar effects on the rates of decomposition of Meisenheimer complexes. NASA

N70-37131# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
STUDY OF THE DIFFUSION OF STABLE HYDROGEN ISOTOPES AND OF THEIR ALLOTROPIC FORMS ACROSS A PALLADIUM MEMBRANE [CONTRIBUTION A L'ETUDE DE LA DIFFUSION DES ISOTOPES STABLES DE L'HYDROGENE ET DE LEURS FORMES ALLOTROPIQUES A TRAVERS UNE MEMBRANE DE PALLADIUM]
Lucien Fitoussi (Ph.D. Thesis—Paris Univ., 5 Nov. 1969) Feb. 1970 121 p refs In FRENCH; ENGLISH summary
(CEA-R-3943) Avail: CFSTI

After the development of apparatus for the continuous measurement of the permeability of palladium to H2 and D2, and a technique for the surface treatment of the palladium membrane, it was possible to measure the permeabilities for t less than 150 C and p less than 100 mm of mercury with a reproducibility of better than 10 per cent. These measurements showed that a surface treatment of the membrane, consisting of air oxidation at 350 C, followed by reduction by H2 or D2, leads to the production of a reproducible physical state which is very favorable for diffusion and it was possible to study the role played by impurities such as CO and O2 which are only slightly condensible at liquid nitrogen temperatures (77 K). Other measurements at t less than 40 C showed (a) that the respective concentrations of the ortho and para varieties in the adsorbed phase and in the gas phase at thermal equilibrium were different, (b) that for t greater than 0 C in the alpha phase, and in the presence of H2 or D2 enriched by the J = 0 variety in the gas phase, the respective ortho-para concentrations remained constant in the adsorbed phase. Under the same conditions, but in the beta phase, an increase was observed in the concentration of the J = 0 variety in the adsorbed phase. In the presence of the Pd membrane, the dissociation energy of the J = 0 varieties were less than those for which J = 1. Author (ESRO)

N70-37143# Commissariat a l'Energie Atomique, La Hague (France). Direction des Productions.
INTERFERENCES IN ATOMIC ABSORPTION SPECTROPHOTOMETRY: SOME EXAMPLES OF ATTENTUATION OR SUPPRESSION [INTERFERENCES EN SPECTROPHOTOMETRIE D'ABSORPTION ATOMIQUE: QUELQUES EXEMPLES D'ATTENUATION OU DE SUPPRESSION]
Henri Rampon Jan. 1970 30 p refs In FRENCH; ENGLISH summary
(CEA-R-3935) Avail: CFSTI

The use of atomic absorption techniques for rapid analyses of radioactive and inactive media, gave data on almost all known types of interferences e.g. interactions due to adjustment parameters and flame emission, and spectral, ionization, matrix and the important chemical interferences. Simple methods exist for detecting and studying these interferences. They can be reduced or suppressed in most cases by use of hot flames (nitrous oxide/acetylene), dilution, neutralization, addition of anti-interference or complexing agents, use of complex standards and separation. The choice of methods is often based on a knowledge of the chemistry of the components of the solution, and on considerations of accuracy, rapidity and efficiency. Author (ESRO)

N70-37185# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
HIGH-TEMPERATURE SOLID ELECTROLYTES [ELECTROLYTES SOLIDES A HAUTE TEMPERATURE]
Jean-Pierre Marcon Apr. 1970 41 p refs In FRENCH; ENGLISH summary
(CEA-BIB-180) Avail: CFSTI

The use of solid electrolytes at high temperatures for measuring the thermodynamic properties of compounds is reviewed. After some theoretical considerations the general case of the ionic conductibility in oxides is treated and some examples are discussed. Author (ESRO)

N70-37187# Atomic Power Development Associates, Inc., Detroit, Mich.
SAMPLING AND ANALYSIS FOR OXYGEN IN SODIUM
M. K. Deora, A. J. Friedland, R. A. Hunter, and J. E. Meyers Apr. 1970 85 p refs
(Contract AT(11-1)-865)
(APDA-246) Avail: CFSTI

All the research conducted at APDA in the area of sampling and analysis for oxygen in sodium is summarized. Pinched and nonpinched bypass freeze tube samplers were used in conjunction with the mercury amalgamation method for the determination of oxygen concentrations which ranged from 7 to 76 ppM. Temperature profiles of the sampling tubes during cooling were studied in an attempt to explain the axial segregation of oxygen. A detailed account is given of the experimental procedures as well as the statistical treatment and interpretation of results. Author (NSA)

N70-37188# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
SEPARATION AND DETERMINATION OF TRANSURANIUM ELEMENTS [SEPARATION ET DOSAGE DES ELEMENTS TRANSURANIENS]
Mohamed Badreldin Hafez (Atomic Energy Estab., Cairo) and Francois Patti Feb. 1970 55 p refs In FRENCH; ENGLISH summary
(CEA-BIB-171) Avail: CFSTI

This literature review deals with the separation of both neptunium and plutonium as well as other actinides by solvent extraction methods particularly separation using ion exchange resins. Other methods for separating transuranium elements are described and the different methods and procedures for the determination of transuranium elements are discussed. Author (ESRO)

N70-37225# Commissariat a l'Energie Atomique, Bruyeres-le-Chatel (France).
SEPARATION OF THE TRANSPLUTONIUM AND LANTHANIDE GROUPS ON ANION RESINS IN THE AMMONIUM THIOCYANATE-PROPANOL-WATER SYSTEM [SEPARATION DES GROUPES TRANSPLUTONIENS ET LANTHANIDES SUR RESINE ANIONIQUE DANS LE SYSTEME THIOCYANATE D'AMMONIUM PROPANOL EAU]
Jean Kwinta and Jean-Jacques Michel May 1970 38 p refs In FRENCH; ENGLISH summary
(CEA-R-3976(Avail: CFSTI

The process described in this report makes it possible to separate trace amounts of the transplutonium elements from the elements of the lanthanide group used as tracers or carriers. It is based on the differences in the stabilities of the complexes formed by the two groups of elements with thiocyanate ions in a water-propanol mixture. Author (ESRO)

N70-37258# California Univ., Lawrence Radiation Lab.
THE CHEMICAL INTERACTIONS OF ACCELERATED C 14 IONS AND ATOMS WITH BENZENE
Tz-Hong Lin (Ph.D. Thesis) Oct. 1969 215 p refs
(Contract W-7405-eng-48)
(UCRL-19335) Avail: CFSTI

Solid benzene at —196 C was irradiated with monoenergetic beams of C-14(+) ions and atoms with kinetic energy ranging from 5 eV to 16 keV. The nature of the reactions involved was investigated by total degradations of toluene; partial degradations of toulene (from 5- to 5000-eV irradiations) and benzaldehyde (from 15- to 5000-eV irradiations); and partial degradations of phenlacetylene, biphenyl, diphenylmethane, and phenylcycloheptatriene from a 5000-eV irradiation. The mechanisms for the product formations were interpreted in terms of the intermediate carbenes and radicals resulting from the C—H and C=C bond insertions of

hot C(3P),C(1D), and C(1S). The dependence of the radiochemical yields of the products upon the energy of the irradiating C-14(+) ions was consistent. It was concluded that, in the accelerated C-benzene system, the hot and thermal C(1S) species react similarly. However, the reactions of hot C(3P) and C(1D) are different from that of the thermal counterparts. Author (NSA)

N70-37281# Atomic Energy Commission, New Brunswick, N.J.
NEW BRUNSWICK LABORATORY Annual Progress Report, Jul. 1968–Jun. 1969
Apr. 1970 64 p refs
(NBL-250) Avail: CFSTI

Research progress is reported on: titrimetric determination of U; rapid separation of U by reversed-phase chromatography and determination by oxidimetric titration; recovery of U from phosphoric acid solution; determination of U after reduction in phosphoric acid by titration; X-ray spectrographic determination of U in U–Zr solutions; automatic determination of U with the Technicon autoanalyzer; gamma self-absorption coefficient in determination of U-235 in solids; controlled-potential coulometric determination of Pu; stability of plutonium sulfate tetrahydrate; determination of Pu by isotope dilution mass spectrometry; determination of U in Pu–U mixtures; determination of C in B and BC; preparation of boron-filled silicone elastomer; analysis of silicone elastomers; getter system for impulse heater gloved box; computer-controlled isotope ratio mass spectrometer; symmetrical cylindrical rotating step sector; and a darkroom timer. NSA

N70-37287# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
ISOTOPIC ANALYSIS OF URANIUM 235 BY EMISSION SPECTROSCOPY. PART 2: DETERMINATION OF THE U-235/U-238 RATIO USING A SPECTROGRAPH AND ELECTRODELESS LAMPS [CONTRIBUTION A L'ANALYSE ISOTOPIQUE DE L'URANIUM 235 PAR SPECTROMETRIE D'EMISSION. DEUXIEME PARTIE: DETERMINATION DU RAPPORT U-235/U-238 A L'AIDE D'UN SPECTROGRAPHE ET AVEC DES LAMPES SANS ELECTRODES]
Robert Capitini, Maurice Ceccaldi, Jean-Pierre Leicknam, and Jacques Rabec Feb. 1970 53 p refs In FRENCH; ENGLISH summary
(CEA-R-3457-Pt-) Avail: CFSTI

This report deals with attempts to analyze uranium isotopes by using a photographic plate spectrograph which has not undergone any modification; the isotopic lines used were located at 4244 A. By making some corrections necessitated by the very rich nature of the uranium spectrum a relative accuracy of about 3 percent in the neighborhood of the natural abundance was obtained; this accuracy can be increased to 1 percent for samples enriched with the U-235 isotope. These results, for routine determinations, are close to those which can be obtained with grating or interferometric equipment which follow the isotopic lines simultaneously. Author (ESRO)

N70-37329# Dow Chemical Co., Golden, Colo. Rocky Flats Div.
INFRARED ABSORPTION SPECTRA OF COMPLEX FORMATES OF THORIUM
O. N. Yevstafeva et al 1970 10 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (USSR), v. 172, 1967 p 860–862 Sponsored by AEC
(PB-191758; RFP-Trans-63) Avail: CFSTI CSCL 07A

In order to compare the spectra of thorium formates with various saturation of the coordination sphere, the following compounds were studied: Th (HCO2)4.3H2O, BaTh (HCO2)6.2H2O, Ca3Th (HCO2)7, and Ca4Th(HCO2)8. Author (USGRDR)

N70-37346*# Translation Consultants, Ltd., Arlington, Va.
SYNTHESIS OF POLYHYDROXY ALCOHOLS BY CONDESING ALIPHATIC ALDEHYDES AND FORMALDEHYDE [POLUCHENIYE MNOGOATOMNYKH SPIRITOV NA OSNOVE AL'DEGIDOV OKSOSINTEZA]
M. M. Ketslakh et al Washington NASA Sep. 1970 11 p refs Transl. into ENGLISH of the book "Karbonilirovaniye Nenasyshchennykh Uglevodorodov" USSR, 1968 p 244–250
(Contract NASw-2038)
(NASA-TT-F-13225) Avail: CFSTI CSCL 07C

A series of aliphatic aldehydes, and on that basis aliphatic polyhydroxy-alcohols, are obtained by hydroformulation of unsaturated hydrocarbons. They are used in the production of epoxy and alkyd resins, surface active reagents, etc., and found to be more valuable than glycerin. Syntheses are described, and it is concluded on the basis of favorable technical and economic indices that it is economically expedient to organize the production of polyhydroxy-alcohols in the USSR. Author

N70-37347*# Translation Consultants, Ltd., Arlington, Va.
PREPARATION OF POLYHYDROXY ALCOHOLS FROM FORMALDEHYDE [POLUCHENIYE MNOGOATOMNYKH SPIRTOV IZ FORMALDEGIDA]
N. S. Imyanitov et al Washington NASA Sep. 1970 8 p refs Transl. into ENGLISH of the book "Karbonilirovaniye Nenasyshchennykh Uglevodorodov", USSR, 1968 p 313–317
(Contract NASw-2038)
(NASA-TT-F-13226) Avail: CFSTI CSCL 07C

The preparation of polyhydroxy-alcohols from formaldehyde is discussed. Two methods are available: condensation with subsequent or with simultaneous hydrogenation. The latter is used with a lead hydroxide catalyst which is gradually dissolved. Author

N70-37349# Kentucky Univ., Lexington. College of Engineering.
A STUDY OF THE PRESSURE BROADENING OF THREE PURE-ROTATION LINES HCl
Kay Paluska Lane, Charles A. Frenzel, and Eugene B. Bradley Apr. 1970 36 p refs *Its* Bull. No. 93
(PB-191176) Avail: CFSTI CSCL 07D

Communication systems of the future will use the far-infrared region of the electromagnetic spectrum extensively. Before use of the submillimeter region of the spectrum becomes practical, components such as filters must be developed and synthesized. The study experimentally establishes the feasibility of using HCl as a variable bandwidth, band-elimination comb filter at specific far-infrared frequencies. The pressure broadening of the J(1), J(2), and J(3) transitions of HCl has been studied using a far-infrared interferometer. Line parameters obtained with the method of equivalent widths are compared with parameters calculated on the basis of Lindholm's pressure-broadening theory. Disagreement with theory and earlier experimental studies are discussed. The observed half-widths of all three transitions are much smaller than predicted by Lindholm, but qualitative agreement with theory is obtained. Thus, the use of a molecular gas, HCl, is shown to be a practical means of constructing far-infrared filters. Author (USGRDR)

N70-37426# Purdue Univ., Lafayette, Ind. School of Materials Science and Metallurgical Engineering.
DIFFUSION AND PRECIPITATION OF INERT GASES IN METALS Technical Progress Report, 1 Jun. 1969–23 Feb. 1970
James R. Cost 23 Feb. 1970 6 p refs
(Contract AT(11-1)-1799)
(PB-191264; COO-1799-3) Avail: CFSTI CSCL 11F

Four sets of specimens, three of aluminum and one of niobium, were irradiated to inject helium. The lattice parameter study for the aluminum-helium system was completed; the results indicate substitutional occupancy for helium in the aluminum lattice.

Calorimetric measurements of the superfluid transition of liquid helium at 2.15 K were made to detect the presence of helium as a precipitated second phase. Over fifteen specific heat runs were made, including calibration with non-irradiated aluminum calibration of the addenda and the thermometer, and measurements on irradiated and annealed specimens. Results indicate that helium pressures are considerably lower in bubbles than is predicted for equilibrium with the surface energy. P.A.B.

N70-37512# Commissariat a l'Energie Atomique, Bruyeres-le-Chatel (France). Centre d'Etudes.
CHROMATOGRAPHY OF ACTINIDES ON ANION EXCHANGE PAPER. BEHAVIOR OF THE ELEMENTS U, Np, Pu, Am IN ACID, AQUEOUS AND ALCOHOL-WATER SOLUTIONS [CHROMATOGRAPHIE DES ACTINIDES SUR PAPIER EXCHANGEUR D'ANIONS COMPORTEMENT DES ELEMENTS (U, NP, PU, AM) DANS DES MILIEUX ACIDES, AQUEUX ET HYDROALCOOLIQUES]
Michel Collin Feb. 1970 25 p refs In FRENCH
(CEA-N-1210) Avail: AEC Depository Libraries

Actinide migration on ion exchange paper was studied first with trace amounts with a view to subsequent application in microanalysis. The first tests made it possible to define the factors having an effect on the migrational velocities of the aqueous and the alcohol-water solutions of HCl and HNO3. The behavior of the actinides was studied in nonsaline acid solutions. The results obtained for each element separately are interesting from the point of view of their mutual separation. NSA

N70-37514# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
PHYSICO-CHEMICAL PROCESSES OF TRANSFER OF RADIORUTHENIUM IN CONTINENTAL ENVIRONMENT [POINTS DE VUE SUR L'ETUDE DES PROCESSUS PHYSICO-CHIMIQUES DU TRANSFERT DES RADIORUTHENIUMES EN MILIEU CONTINENTAL]
R. Bittel (Comm. a l'Energie Atomique, Fontenay-aux-Roses, France), J. M. Blum, J. J. Jaumier, and J. L. Verot 1969 16 p refs In FRENCH Presented at Conf. on Radioecology, Cadarache, France, 8-11 Sep. 1969 Prepared in cooperation with Ugine-Kuhlmann S. A., Paris
(CEA-CONF-1430; CONF-690918-3) Avail: AEC Depository Libraries

The physical chemistry of ruthenium is complicated because of the numerous valence states corresponding to salt combinations and complexes. Two radioisotopes of Ru with average life, Ru-106 and Ru-103, are present in numerous liquid radioactive effluents. This is evidently the result of the difficulties of decontamination and is explained as a function of the physical chemistry of the element. Therefore, these Ru radioisotopes can contribute to the contamination of the continental environment. In liquid effluents and their emunctories, the radioisotopes have various physicochemical states and it seems probable that the varied behavior of Ru in the dispersion medium is explained in part by differences between the physicochemical states of the element. The conditions of use of these compounds are discussed as well as data to be attained from experiments using these compounds for the study of the transfer of radioruthenium into the continental environment. Author (NSA)

N70-37518# State Univ. of New York, Stony Brook. Dept. of Mechanics.
ACCURACY OF CLOSURES FOR STOCHASTICALLY DISTRIBUTED ARBITRARY ORDER REACTANTS
Edward E. O'Brien and Ronald M. Eng Jan. 1969 124 p refs
(Grant NSF GK-17-15)
(PB-190134; Rept-124) Avail: CFSTI CSCL 07A

The closures satisfy prescribed realizability and asymptotic conditions for certain ranges of initial values of the mean, mean square fluctuations, third order moments, and fourth order moments of the concentration field. The restrictions on initial values are given in terms of dimensionless ratios that are independent of the form of the closures. The closures were applied to two different probability distributions to determine the accuracy of the closures. It was found that: (1) Violation of the prescribed limits on the initial values of the moments led to severely unphysical, unacceptable behavior in the time history of some or all of the moments considered, and (2) When initial moments were within the allowable limits, proper qualitative behavior was exhibited in all cases. Author (USGRDR)

N70-37561*# Scientific Translation Service, Santa Barbara, Calif.
TREND IN THE MICROANALYSIS OF SYNTHETIC DETERGENTS
Shigeo Hayano Washington NASA Sep. 1970 22 p refs Transl. into ENGLISH from Seisan-Kenkyu (Tokyo), v. 20, no. 2, 1968 p 78-83 (30-35)
(Contract NASw-2035)
(NASA-TT-F-13202) Avail: CFSTI CSCL 07D

To resolve water pollution problems by synthetic detergents, a critical review is given for microanalysis methods of cationic surfactants and nonionic sufactants. It is concluded that JIS K333 (bacterial decomposition test method) in Japan cannot be considered as established for the cationic surfactants, and the Burttchell method (1966) is most promising for the nonionic surfactants. Author

N70-37544*# Scientific Translation Service, Santa Barbara, Calif.
THERMALLY STABLE POLYMERS
I. Mita Washington NASA Sep. 1970 32 p refs Transl. into ENGLISH from Kogyo Kagaku Zasshi (Tokyo), v. 73, no. 7, 1970 p 107-117
(Contract NASw-2035)
(NASA-TT-F-13173) Avail: CFSTI CSCL 07C

Thermal stability of polymers described as related to other properties (heat aggregation of molecules, chemical properties, physical properties). An extensive classification of polymers is given based on their structure. Melting points and softening of a number of polymers are given. Author

N70-37577# National Inst. for Metallurgy, Johannesburg (South Africa). Analytical Chemistry Div.
RAPID ESTIMATION, BY THE AMMONIUM THIOCYANATE METHOD, OF URANIUM IN RAFFINATE SOLUTIONS CONTAINING THORIUM, LEAD, AND COPPER
E. B. T. Cook and T. W. Steele 29 May 1969 4 p refs /fs Lab. Method No. 92/60
(NIM-503) Avail: AEC Depository Libraries

A method applicable to solutions of as low a concentration of U as 0.05 g/1, and of as high a concentration of Th and HNO3 as 100 and 160 g/1, respectively, is described. The pH value of the sample is adjusted to about 1.2, the ferric ion reduced by addition of SnCl2 solution, and the uranium thiocyanate complex formed by addition of ammonium thiocyanate. The uranium content is then determined spectrophotometrically. NSA

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation; telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N70-36239# Environmental Science Services Administration, Boulder, Colo. Research Labs.
ON LAUNCHING AN AZIMUTHAL SURFACE WAVE ON A CYLINDRICAL IMPEDANCE BOUNDARY
James R. Wait 10 Mar. 1970 19 p refs
(Contract PRO-Y-70-818)
(AD-704561; AFCRL-70-0174; SR-49) Avail: CFSTI CSCL 20/14

The launching of azimuthal surface waves on a cylindrical boundary is considered. The excitation aperture is the open end of a waveguide whose outer wall is concentric with the cylindrical reactive boundary. The exact formal solution of the dual integral equations is cast in a form which shows the close similarity with the result predicted by Kirchhoff theory. The general solution for the fields is reduced in order to discuss the excitation of the dominant surface wave on a purely reactive boundary. Author (TAB)

N70-36266# Naval Postgraduate School, Monterey, Calif.
AN ACOUSTIC DIGITAL DATA LINK
Raymond Joseph Hopkins (M.S. Thesis) Jun. 1969 32 p refs
(AD-703227) Avail: CFSTI CSCL 17/2

A design study of various possible methods of developing an underwater data link to monitor a deep ocean capsule was undertaken. The capsule is designed to remain on the ocean floor for a year, and the data link is required to periodically sample the data being recorded and send it to a surface buoy for relay to a shore station. A comparative engineering evaluation of the possible systems was made. Author (TAB)

N70-36273# Parke Mathematical Labs., Inc., Carlisle, Mass.
GENERAL TRANSDUCER ARRAY ANALYSIS
Charles H. Sherman Feb. 1970 46 p refs
(Contract N00014-67-C-0424)
(AD-702784; Rept-0424-SR-6) Avail: CFSTI CSCL 17/1

A mathematical model for transducer arrays is developed which is not restricted to fixed velocity distribution transducers. The model is general enough to cover most transducers of interest for sonar applications. Its formulation is also explicit and simple enough to make it readily usable in transducer and array design. It is especially well suited for analyzing the effects of transducer head flexing. The use of the model is illustrated by some discussion of a spherical array of longitudinal vibrator transducers with rectangular heads. Numerical calculations are given here for one transducer in air, and for this case some results related to head flexing are obtained and discussed. Author (TAB)

N70-36312# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MOTION PICTURE AND TELEVISION ENGINEERING, VOLUME 12, NO. 1
I. V. Akhutin et al 22 Dec. 1969 17 p refs Transl. into ENGLISH from Tekhn. Kino i Televideniya (Moscow), v. 12, no. 1, 1968 p 47–51
(AD-703152; FTD-MT-24-336-69) Avail: CFSTI CSCL 17/2

Contents: Peculiarities of transfer characteristics of a differentiating camera tube; and Contour tracking of simple figures by means of radius vector tracking scan. TAB

N70-36323# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
VARIATION IN 2.2 MHz IONOSPHERIC ECHO STRUCTURE CORRELATED WITH HIGH POWER 4.6 MHz TRANSMISSIONS
G. J. Palatucci 1 Apr. 1970 127 p refs
(Contract Nonr-656(36); Grant NSF GA-1456)
(AD-706227; SR-352) Avail: CFSTI CSCL 4/1

It has been shown experimentally that certain features of the ionospheric echo structure of 2.2 MHz pulses are correlated with the on-off time of a high power pulse transmitter operated at 4.6 MHz. Photographic and electronic data are presented which show examples in which the h(f) of the main echoes changed by a few kilometers with a characteristic time in the order of 10 to 60 seconds during the high power transmissions. A number of photographic records are also presented which show the abrupt appearance of sporadic E echoes during the high power intervals. A theoretical investigation into the possible cause for these experimental results is given. Author (TAB)

N70-36333# Naval Postgraduate School, Monterey, Calif.
PRELIMINARY INVESTIGATION OF A PROPOSED SONOBUOY RANGING SYSTEM Preliminary Investigation
Gary Maxwell Grant (M.S. Thesis) Jun. 1969 69 p refs
(AD-705497) Avail: CFSTI CSCL 17/1

The ability to locate and determine the position of an ASW sonobuoy is an essential part of airborne anti-submarine operations. Present methods restrict the parent aircrafts operational capability and yield only marginal data. State-of-the-art frequency control makes it possible to range sonobuoys accurately with radio signals. Sonobuoy position can then be determined by combining this range data with other available information. A system is proposed to both free the parent aircraft from present restrictions and to increase the accuracy of the position information. Author (TAB)

N70-36370# Ionospharen-Institut Breisach (West Germany).
IONOSPHERE DATA, VERTICAL-ECHO-SOUNDING: FREIBURG, URSI-CODE 131, MAY 1970 [IONOSPHAEREN-DATEN, VERTIKAL-ECHO-LOTUNG: FREIBURG, URSI-CODE-131, MAI 1970]
May 1970 51 p In GERMAN and ENGLISH
(Rept-287-F) Avail: CFSTI

Ionospheric data are presented in tabular form and include wave critical frequencies for the F sub 2, F sub 1, and the E sub 1 layers of the atmosphere; virtual height of wave branch for F sub 2 and the E layer, and transmission factors. Several measuring inconsistencies and some modified measurements using interpolation are included in the tables. E.H.W.

N70-36372*# Notre Dame Univ., Ind. Dept. of Electrical Engineering.
CONVOLUTIONAL CODING TECHNIQUES FOR DATA PROTECTION Final Report, 16 Sep. 1968 – 15 Sep. 1969
James L. Massey 22 Jul. 1970 9 p refs
(Grant NGL-15-004-026)
(NASA-CR-112403) Avail: CFSTI CSCL 09D

Summaries of the work and some of the results are given for each of following six categories on data protection techniques: (1) contributions to the general theory of convolutional codes, (2) development of powerful quick-look-in nonsystematic convolutional codes, (3) contributions to sequential decoding, (4) unified analysis of decoders for convolutional codes, (5) inverses of linear systems, and (6) sub baud coding. Author

N70-36383# Environmental Science Services Administration, Boulder, Colo.
PROPAGATION OF ELECTROMAGNETIC WAVES OVER A SMOOTH MULTI-SECTION CURVED EARTH: AN EXACT THEORY
James R. Wait 4 Mar. 1970 37 p refs
(Contract PRO-CP-69-824)
(AD-704560; AFCRL-70-0140; SR-48) Avail: CFSTI CSCL 20/14

The report presents a self-contained exposition of ground wave propagation over a smooth inhomogeneous earth model. A factorization procedure is used to obtain an exact solution for a two-dimensional cylindrical model which may have any number of homogeneous sections. It is demonstrated that under most

conditions in practice, the solution for the mode conversion coefficients can be simplified to a form which was derived earlier by an application of the compensation theorem. Formulas are given which permit the refinement of earlier approximate calculations if such accuracy is required in future engineering developments such as precise navigation systems. Author (TAB)

N70-36428# Aerospace Corp., El Segundo, Calif. Lab. Operations.
GENERAL RELATIVITY TWO-WAY DOPPLER SHIFT, REPORT FOR APRIL–JUNE 1969
Gilberto Ialongo 15 Apr. 1970 32 p refs
(Contract F04701-68-C-0066)
(AD-704585; TR-0066(5110-01)-4; SAMSO-TR-70-137) Avail: CFSTI CSCL 20/14

On the basis of the metric in a gravitational field, a two-way Doppler shift is obtained for an arrangement in which a signal sent from a ground-based transmitter is received by a satellite, retransmitted, and picked up by a receiver. The geometry used is quite general, and the formula obtained is correct to order (v/c)cubed included. When both transmitter and receiver are on the earth, much of the general relativistic effect is seen to drop out. Various limits of the Doppler shift formula are considered. Author (TAB)

N70-36429# Hitachi, Ltd., Tokyo (Japan).
MEASUREMENT OF PULSE CROSSTALK ON SYMMETRIC TYPE CABLE
K. Okamoto, T. Asai, and Y. Hashimoto 1969 14 p Presented at the 18th Intern. Wire and Cable Symp., Atlantic City, 3-5 Dec. 1969
(AD-698623) Avail: CFSTI CSCL 17/2

Observation of distribution of crosstalk coupling using equalizers was discussed theoretically and on the basis of experiments. Because of thermal noise from equalizers, the equalizing range cannot be enlarged, as a result of which limits are imposed on resolution in observation. Nevertheless, it was demonstrated that the method is an effective means of quality control aimed at locating large crosstalk couplings in a long cable. Author (TAB)

N70-36439*# North Carolina State Univ., Raleigh. Dept. of Electrical Engineering.
STUDY OF RECTANGULAR-GUIDE-LIKE STRUCTURES FOR MILLIMETER WAVE TRANSMISSION Progress Report, 1 Feb.–31 May 1970
Frederick J. Tischer 15 Jun. 1970 90 p refs
(Grant NGL-34-002-047)
(NASA-CR-112401) Avail: CFSTI CSCL 09A

CONTENTS:

1. H-GUIDE WITH LAMINATED DIELECTRIC SLAB F. J. Tischer p 6–12 refs (See N70-36440 20-07)
2. RESULTS OF LIGHT REFLECTANCE MEASUREMENTS FROM ROUGH SURFACES p 13–30 refs (See N70-36441 20-23)
3. AN IMPROVED Q-VALUE MEASUREMENT TECHNIQUE p 31–39 refs (See N70-36442 20-07)
4. CHARACTERISTICS OF DENSE WIRE GRIDS p 40–49 refs (See N70-36443 20-07)
5. FENCE GUIDE MEASUREMENTS p 50–58 (See N70-36444 20-07)
6. STUDY OF OPEN RESONATORS WITH CYLINDRICAL REFLECTORS p 59–66 refs (See N70-36445 20-07)
7. OPEN-WAVEGUIDE CHARACTERISTICS BY FIELD MATCHING p 67–87 refs (See N70-36446 20-07)

N70-36440*# North Carolina State Univ., Raleigh. Dept. of Electrical Engineering.
H-GUIDE WITH LAMINATED DIELECTRIC SLAB
Frederick J. Tischer *In its* Study of Rectangular-Guide-Like Struct. for Millimeter Wave Transmission 15 Jun. 1970 p 6–12 refs Reprinted (See N70-36439 20-07)
Copyright. Avail: CFSTI CSCL 09A

Consideration of the field distribution and the characteristics of an H guide with a laminated dielectric bar composed of an arbitrary number of dielectric strips separated by air layers is presented. Low-loss wave modes with the electric field intensity predominantly parallel to the sidewalls are analyzed. Approximate thin-layer equations are derived which indicate methods for improvements of the attenuation of the H guide. Author

N70-36442*# North Carolina State Univ., Raleigh.
AN IMPROVED Q-VALUE MEASUREMENT TECHNIQUE
In its Study of Rectangular-Guide-Like Struct. for Millimeter Wave Transmission 15 Jun. 1970 p 31–39 refs (See N70-36439 20-07)
Avail: CFSTI CSCL 20N

A method using a modulated oscillator for the frequency indication which gives Q-values accuracy of + or – 50 parts out of 8000 is described. It was established that more stringent requirements were created by surface-resistance. A description of the setup is also given. E.M.C.

N70-36443*# North Carolina State Univ., Raleigh.
CHARACTERISTICS OF DENSE WIRE GRIDS
In its Study of Rectangular-Guide-Like Struct. for Millimeter Wave Transmission 15 Jun. 1970 p 40–49 refs (See N70-36439 20-07)
Avail: CFSTI

The characteristics of wire grids with narrowly spaced wires are considered. The presently used equations are reviewed from the viewpoint of their application at decreasing spacing between the wires. Modified equations are developed for lossless and lossy grids for the region of spacing between zero and values where customary equations can be applied. Author

N70-36444*# North Carolina State Univ., Raleigh.
FENCE GUIDE MEASUREMENTS
In its Study of Rectangular-Guide-Like Struct. for Millimeter Wave Transmission 15 Jun. 1970 p 50–58 (See N70-36439 20-07)
Avail: CFSTI CSCL 09A

Measurements of the field distribution in 175 mm long fence guide sections are discussed and an evaluation of the parameters is made. Author

N70-36445*# North Carolina State Univ., Raleigh.
STUDY OF OPEN RESONATORS WITH CYLINDRICAL REFLECTORS
In its Study of Rectangular-Guide-Like Struct. for Millimeter Wave Transmission 15 Jun. 1970 p 59–66 refs (See N70-36439 20-07)
Avail: CFSTI CSCL 09A

An experimental investigation of a non-confocal open resonator with cylindrical reflectors is reported. The resonator was operated at 36.8GHz. Measurements were made of the Q-value and of the field distributions as a function of reflector spacing. Mode numbers were obtained from these plots and an attempt was made to find relationships between the mode numbers m,n,p, the spacing 'b' between the reflectors, and the Q-value. Author

N70-36446*# North Carolina State Univ., Raleigh.
OPEN-WAVEGUIDE CHARACTERISTICS BY FIELD MATCHING
In its Study of Rectangular-Guide-Like Struct. for Millimeter Wave Transmission 15 Jun. 1970 p 67–87 refs (See N70-36439 20-07)
Avail: CFSTI CSCL 09A

Field matching method is used for considering a parallel-wall waveguide. Herewith the cross-section is subdivided into regions, those between the center conductor and the sidewalls and those adjacent to the former. The potential equations derived for the various regions contain two sets of unknown coefficients. To determine these coefficients, potential and E-field are matched at the boundary surfaces between the regions. The resultant set of infinite simultaneous equations is solved on the computer using a 20-term approximation. The potential distributions in x and y directions along two lines are plotted and compared with the result of a numerical solution. The line impedance is obtained for several sizes of the center conductor and a plot is given. Author

N70-36458# Aerospace Corp., El Segundo, Calif. Lab. Operations.
METHOD OF DOPPLER DATA PROCESSING FOR ORBIT DETERMINATION, REPORT FOR JUNE – AUGUST 1969
Gilberto Ialongo 10 Oct. 1969 19 p refs
(Contract F04701-69-C-0066)
(AD-704587; TR-0066(5110-01)-5; SAMSO-TR-70-154) Avail: CFSTI CSCL 17/2

A range rate expression is derived starting from a general relativistic Doppler shift formula. This expression differs from the one presently used by a term F(theta, phi). The inclusion of this term, which vanishes for near-Earth geometries, allows range rate determination to better than 1 cm/sec. Author (TAB)

N70-36484*# Radio Corp. of America, Princeton, N.J. Astro-Electronics Div.
NIMBUS-D HIGH DATA RATE STORAGE SYSTEM Final Report, 28 Apr. 1967 – 6 Feb. 1970
17 Apr. 1970 201 p refs
(Contract NAS5-10396)
(NASA-CR-112400; AED-R-3548-F) Avail: CFSTI CSCL 14C

The development of a two-frame center connected multiplexer, a slightly modified electronics module, and a modified tape transport for the HDRSS-D program is discussed. The multiplexer, qualified at prototype levels, contains improved crystal mounts, new adder and telemetry circuits, a modified IRIS channel, and a new VIP channel similar to the IRIS channel. The electronics module was modified to include a new VIP channel and a widened IRIS channel. The tape transport, operational during lauch, contains a brake mechanism, an optical end-of-tape sensor, and a method for cleaning the magnetic heads. Analysis of the test data from the prototype multiplexer and the flight model systems show conformance with the performance specifications. The use of the widened IRIS channel did not have pronounced effects on the test results; however, analytical and empirical measurements on inter-symbol interference shows that detection of data transmitted from the satellite and via the long lines is improved. Bit Error rate tests of the VIP and IRIS channels using the worst-case word pattern produced test results well below specifications. A complete data summary is presented. Author

N70-36567*# General Electric Co., Schenectady, N.Y. Tube Dept.
CIRCUIT EFFICIENCY ENHANCEMENT STUDIES AT 12 GHz Final Report
G. M. Branch 29 May 1970 67 p refs
(Contract NAS3-11533)
(NASA-CR-72696) Avail: CFSTI CSCL 09E

As part of a continuing program to develop the technology required for high-power broadcasting from satellite-borne television transmitters, an analytic and experimental study was conducted to enhance the efficiency of the system in utilizing available power by increasing the circuit efficiency of the klystron power amplifier. A new toroidal cavity was developed that effectively combines the high electron-beam interaction impedance capability of reentrant cavities with the lower internal power losses more characteristic of spherical cavities. Author

N70-36577*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SUPER-HIGH-FREQUENCY (SHF) COMMUNICATIONS SYSTEM PERFORMANCE ON ATS. VOLUME 1: SYSTEM SUMMARY
Aug. 1970 229 p refs
(NASA-TM-X-65304; X-460-70-299) Avail: CFSTI CSCL 17B

The SHF communications system which encompasses a program of design, manufacture, operation and evaluation is studied. The system provides two modes of operation, multiple access (SSB-FDMA/PhM) and frequency translation (FM/FM). The SSB-FDMA/PhM mode is designed to handle frequency division multiplex (FDM) signals while the FM/FM mode is designed to handle television signals as well as FDM. The test program was based on five satellites and three earth stations representing different capabilities and locations. Author

N70-36584*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EQUATORIAL SCINTILLATIONS EXPERIENCED DURING APOLLO 13 SUPPORT, 30 MARCH – 18 APRIL 1970
George K. Kuegler (Westinghouse Electric Corp.) Jun. 1970 30 p refs Submitted for publication
(Contract NAS5-21129)
(NASA-TM-X-65302; X-460-70-240) Avail: CFSTI CSCL 17B

During Apollo 13 support by the ATS project, three signal levels were recorded at either of the ATS ground stations. Selected data from the recordings are depicted to indicate the fine grain structure of equatorial scintillations as well as the peak-to-peak variations encountered. Signal level recordings made during the Apollo 11 support and the world wide VHF tests are also included to confirm the fine grain structure of the equatorial scintillations encountered in the Apollo 13 support. The effects of the ships roll on the recorded signal level is also indicated. Author

N70-36663*# Texas Technological Univ., Lubbock. Dept. of Electrical Engineering.
PERFORMANCE IMPROVEMENT ANALYSIS FOR THE APOLLO UNIFIED S-BAND SYSTEM Semiannual Progress Report
R. D. Shelton 30 Jun. 1970 15 p refs
(Grant NGR-44-011-026)
(NASA-CR-112364) Avail: CFSTI CSCL 17B

Publications and progress reports relating to the development of communications systems analysis technique are summaried according to type in tabular form. They are then discussed by subject, including progress in the fields of techniques for computer simulation of communications systems, computer aided analysis technique development, methods of phase lock loop performance improvement, angle modulation distortion analysis techniques, and signal parameter estimation methods. P.A.B.

N70-36771*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A PREDETECTION POLARIZATION DIVERSITY COMBINER
Chase P. Hearn Washington Sep. 1970 29 p refs
(NASA-TN-D-5975; L-7057) Avail: CFSTI CSCL 17B

Described is the theory, development, and laboratory performance of an experimental polarization diversity combiner. The combiner operates in conjunction with orthogonally polarized S-band antenna feeds and pedestal-mounted downconverters. The system is designed to eliminate effectively the received signal loss caused by polarization mismatch, and will accommodate radiofrequency bandwidths as large as 9 MHz. The use of a multiloop carrier tracking servomechanism for phase-coherent combination of the input signals limits the system application to the class of modulated signals having carriers. Author

N70-36796+ British Broadcasting Corp., Kingswood (England). Research Dept.

UHF RADIO LINKS: 2.5 GHz TRANSMITTING AERIALS FOR MOBILE RADIO CAMERAS

N. H. C. Gilchrist and J. H. Moore Jun. 1970 7 p ref
(Rept-1970/20; RA-61) Avail: CFSTI

Two aerials for use on moving vehicles are described: a biconical 60 degree aerial and a Franklin-type 30 degree aerial. They offer a choice of two vertical directivities while maintaining an omnidirectional horizontal radiation pattern. Author

N70-36797+ British Broadcasting Corp., Kingswood (England). Research Dept.

THE DESIGN OF REPLACEMENT AERIALS FOR MOORSIDE EDGE

P. Knight Jun. 1970 5 p refs
(Rept-1970/21; RA-64) Avail: CFSTI

The design of a medium frequency aerial system is described. The effect of the hilly nature of the surrounding area on the performance of the aerials is discussed, and it is concluded that no advantage could be gained by center-feeding. Author

N70-36798+ British Broadcasting Corp., Kingswood (England). Research Dept.

OBSERVATIONS OF THE STABILITY OF THE PROPAGATION TIME OF A LONG TELEVISION LINK

D. W. Osborne Jul. 1970 4 p ref
(Rept-1970/23; EL-44) Avail: CFSTI

The synchronization of color television signal source is facilitated by the use of stable subcarrier and scanning frequencies. However, when the signals have to travel long distances to the point of synchronism, the time stability of the video link is important if unwanted phase variations are to be avoided. Tests on the London to Glasgow video circuit show that such variations are small. Author

N70-36828*# Bell Telephone Labs., Inc., Murray Hill, N.J.

VLF EXPERIMENT EQUIPMENT FOR APPLICATIONS TECHNOLOGY SATELLITE-2 (ATS-2) Final Report

1 Aug. 1969 291 p refs Prepared for Western Electric Co., Inc., N.Y.
(Contract NAS5-9635)
(NASA-CR-112346) Avail: CFSTI CSCL 17B

CONTENTS:

1. THE VLF EXPERIMENT EQUIPMENT FOR APPLICATIONS TECHNOLOGY SATELLITE-2 (ATS-2) 38 p refs (See N70-36829 20-07)

2. DESIGN OF VLF AND PARTICLE EXPERIMENTS FOR THE ATS-A SATELLITE WITH SPECIAL REFERENCE TO ELECTROMAGNETIC INTERFERENCE, APPENDIX 1 G. L. Miller and H. P. Lie 44 p refs (See N70-36830 20-07)

3. PARTICLE DETECTION EXPERIMENT FOR APPLICATIONS TECHNOLOGY SATELLITE-1 (ATS-1), APPENDIX 2 W. M. Augustyniak, W. L. Brown, I. Hayashi, H. E. Kern, R. W. Kerr et al 270 p refs (See N70-36831 20-09)

N70-36829*# Bell Telephone Labs., Inc., Murray Hill, N.J.

THE VLF EXPERIMENT EQUIPMENT FOR APPLICATIONS TECHNOLOGY SATELLITE-2 (ATS-2)

In its VLF Expt. Equipment for Appl. Technol. Satellite-2 (ATS-2) 1 Aug. 1969 38 p refs Prepared for Western Electric Co., Inc., N.Y. (See N70-36828 20-07)
Avail: CFSTI CSCL 17B

A description of the packaging of the VLF radio experiment and its integration with the energetic particle experiment in a common housing is given. Areas discussed include the experiment-spacecraft interface, main housing design, VLF electronics packaging, antenna coil, and antenna electronics. A full component of diagrams illustrate the text. P.A.B.

N70-36830*# Bell Telephone Labs., Inc., Murray Hill, N.J.

DESIGN OF VLF AND PARTICLE EXPERIMENTS FOR THE ATS-A SATELLITE WITH SPECIAL REFERENCE TO ELECTROMAGNETIC INTERFERENCE, APPENDIX 1

G. L. Miller and H. P. Lie *In its* VLF Expt. Equipment for Appl. Technol. Satellite-2 (ATS-2) 1 Aug. 1969 44 p refs Prepared for Western Electric Co., Inc., N.Y. (See N70-36828 20-07)
Avail: CFSTI CSCL 17B

A description of the VLF experiment and its special integration problems with the spacecraft is presented. Special steps taken to minimize noise problems are given, and laboratory radio frequency interference measurements on the experiments and around the operating spacecraft are described. Analysis of the data received from the experiment in orbit is discussed with relation to positive identification of spacecraft noise, including identification of signals by the AND and PHASE conditions and the function of the inflight calibration system. The five detector telescope experiment used to differentiate between electrons, protons, and alpha particles and to measure their energy spectra is also described. Noise considerations and electromagnetic interference protection methods are summarized. P.A.B.

N70-36836# Weapons Research Establishment, Salisbury (Australia).

A SURVEY OF THE SOUTHERN SKY AT 55 MHz

P. Rohan and L. B. Soden May 1969 9 p ref
(WRE-TN-PAD-168) Avail: CFSTI

Measurements are presented of radio noise temperature distribution over the southern sky at a frequency of 55 MHz. The equipment used and the method of measurement are described, and an estimate is made of the accuracy of the data presented. Author

N70-36837*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

SPACE PROGRAMS SUMMARY NO. 37-63, VOLUME 2, FOR THE PERIOD 1 MARCH TO 30 APRIL 1970. DEEP SPACE NETWORK

31 May 1970 129 p refs
(Contract NAS7-100)
(NASA-CR-112670; JPL-SPS-37-60-Vol-2) Copyright. Avail: CFSTI CSCL 17B

The Deep Space Network, designed for two way communications with unmanned spacecraft traveling approximately 10,000 miles from earth to planetary distances, is described, along with its telemetry system. Mission support is discussed for interplanetary and planetary flight projects, including Pioneer, Mariner Mars 1971, and Viking missions. Tracking and navigational accuracy analysis and communications elements research are described in such areas as a solution for the tropospheric zenith range correction, correction factors for near field horn antenna gain measurements, compilation of wind tunnel coefficients for parabolic reflectors, and polarization converters. Development and implementation reports include a cable wrap-up system for the 210-ft diameter antenna, multiple primary feed cone installation and alignment, microwave link relocation, the multiple mission command system, and control configurations for future projects. Also discussed are the reference standards frequency and timing laboratory, radio science support, a time synchronized VLF phase tracking receiver, and a method of counting doppler with the digital tracking subsystem. For Vol. 1, see N70-36379 through N70-36382. P.A.B.

N70-36838# Weapons Research Establishment, Salisbury (Australia).

THE DEMODULATION OF FM SIGNALS USING A DIGITAL COMPUTER

H. H. Evans and A. P. Clarke Mar. 1969 25 p refs
(WRE-TN-TSD-37) Avail: CFSTI

As part of a general investigation into methods of processing time division multiplexed FM telemetry records, the use of a digital computer to demultiplex and demodulate the signal is examined. A computer algorithm for demodulation is described. The algorithm was analyzed theoretically and by digital modelling; the results of both analyses are quoted and indicate substantial agreement. This digital computer approach is contrasted with conventional analog techniques and shown to be markedly superior. Author

N70-36874# Naval Research Lab., Washington, D.C. Radar Div.
A STUDY OF SEA RETURN AT NORMAL AND NEAR-NORMAL INCIDENCE Final Report
O. D. Sledge and S. F. George 30 Jan. 1970 25 p refs
(AD-702735; NRL-7005) Avail: CFSTI CSCL 8/3

Recently, interest has been manifested in using the sea return observed by an airborne radar as a possible continuous monitor of the condition of the sea surface. As a step in analytically evaluating the concept, a brief study is presented of the sea return as seen by a radar viewing the sea at near-normal incidence. Author (TAB)

N70-36881*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Telecommunications Div.
COMMUNICATIONS SYSTEMS RESEARCH
In its Space Programs Sum. No. 37-62, Vol. 3, 30 Apr. 1970 p 57-79 refs (See N70-36876 20-34)
Copyright. Avail: CFSTI CSCL 04D

Studies in coding and synchronization, combinatorial communication, and discretionary research are reported. An efficient modulation-demodulation telemetry system, Interplex, was developed which performs better than the current method. The optimization of acquisition time for sequential ranging system is determined numerically using equal integration times except for the HF component. Ramsey bounds for the coefficients of internal stability of graph products, and an upper bound of the free distance of a tree code are discussed. A mathematical theory is developed for epsilon entropy and data compression for spacecraft-to-earth communication links. A simple sequence-permutatuion method for disguising speech is described which uses essentially identical encoders and decoders. N.E.N.

N70-36882*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Telecommunications Div.
COMMUNICATIONS ELEMENTS RESEARCH
In its Space Programs Sum. No. 37-62, Vol. 3 30 Apr. 1970 p 80-89 refs (See N70-36876 20-34)
Copyright. Avail: CFSTI CSCL 09E

Studies on large spacecraft antennas are discussed. A performance comparison was made of high gain antenna configurations, with Cassegrain and focal point feeds. It was found that the focal point antennas are preferable below 130-inch diameter and the Cassegrain antennas above 130-inch diameter. The method and results of an easy way to calculate axial defocussing loss are presented. It is shown that the loss is strongly dependent on the focal length-to-diameter ratio, but only moderately sensitive to the illumination shape. N.E.N.

N70-36884*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Telecommunications Div.
SPACECRAFT COMMUNICATIONS SYSTEMS
In its Space Programs Sum. No. 37-62, Vol. 3 30 Apr. 1970 p 93-124 refs (See N70-36876 20-34)
Copyright. Avail: CFSTI CSCL 17B

Research on communication equipment and theory is reported. The experimental setup, software, and results are described for the preliminary system testing of an all-digital command detection algorithm for the thermoelectric outer planet spacecraft. The discrete phase of a sample signal was estimated using minimum mean square error performed by the digital correlation technique, and it was shown that the technique can be minimized by the proper choice of sampling rate. A receiver structure for a single channel, phase coherent communication system is described that forms the maximum a posteriori estimate of the RF phase. A hybrid carrier and modulation tracking loop is discussed. The error probability of a wide-band frequency shift keyed receiver is calcualted including the effects of multipath distortion using both a low and a high fading bandwidth. The effects of synchronization jitter on relay performance are investigated for a lander-orbiter-earth relay communication link, and steady state performance is presented for a Gaussian jitter density function assumption. N.E.N.

N70-36911* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RADAR RANGING RECEIVER Patent
Mahlon F. Easterling, inventor (to NASA) Issued 11 May 1965 (Filed 2 Apr. 1962) 6 p Cl. 343-17.2 Sponsored by NASA
(NASA-Case-XNP-00748; US-Patent-3,183,506;
US-Patent-Appl-SN-184649) Avail: US Patent Office CSCL 17I

A radar signal receiving system arrangement is described which is intended to extend the range of the system and increase the signal to noise ratio of the received signal. The incoming signal, comprising a carrier frequency which is phase modulated by the product of clock and code signals, is first heterodyned down to a suitable intermediate frequency. This intermediate frequency is heterodyned with a signal consisting of an oscillation at the intermediate frequency which is balance modulated by code signals indentical with those modulated on the incoming signal. The clock signals modulated on the incoming signal may thus be detected; these are used to synchronize a code generator identical with one in the transmitter. The output of the code generator is then compared in phase with the transmitter code generator for providing distance information. P.A.B.

N70-36934# Technische Hogeschool, Eindhoven (Netherlands).
MEASUREMENT OF VERY-LOW FREQUENCY NOISE
Julio Lopez de la Fuente 30 Jun. 1970 108 p refs
Avail: CFSTI

Certain types of electronic noises are measured in amplifiers, resistors, semiconducturs, thermistors, photoconductors, and MOS transistors. The specific physical origin or possible sources of noise are treated. This treatment lead to the design of a low noise measuring system for random phenomenon and helped obtain new insights into the nature of noise in the very low frequency range. The noise energy spectrum is measured and certain behavior properties of some electronic components are determined. E.H.W.

N70-36949# National Aviation Facilities Experimental Center, Atlantic City, N.J.
ATS-1 VHF COMMUNICATIONS EXPERIMENTATION Final Report, May 1967-Dec. 1969
F. W. Jefferson Jun. 1970 87 p
(FAA-RD-70-12; FAA-NA-70-22) Avail: CFSTI

Eight flight tests were conducted utilizing the Applications Technology Satellite-1 (ATS-1) to obtain characteristic data of VHF communications links via satellite relay for use in over-ocean air traffic control subsystem design studies. Measurements of signal level, signal plus noise-to-noise radio, multipath propagation, voice intelligibility, adjacent channel interference, and 75, 1200, and 2400 bits-per-second digital communications performance were obtained. In general, overall communications reliability using the ATS-1 link was considered marginal. Author

N70-36984*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
POYNTING FLUX STUDIES OF HISS WITH THE INJUN 5 SATELLITE

Stephen R. Mosier Apr. 1970 39 p refs
(Contracts NAS5-10625; NAS1-8141; NAS1-8144(f); NAS1-8150(f); Grant NGR-16-001-043 et al Contract N00014-68-A-0196-003)
(NASA-CR-112770; Rept-70-35) Avail: CFSTI CSCL 20N

A study of very low frequency hiss emissions in the region 677 to 2528 km and 35 deg to 75 deg invariant latitude (in the Northern Hemisphere) using the Injun 5 Poynting flux measurement technique is presented. Downgoing ELF hiss is observed over the entire region of altitude-invariant latitude space under study, whereas ELF hiss having an upward-directed net Poynting flux is only observed at invariant latitudes below about 60 deg. A new propagation phenomenon is proposed in which downgoing ELF hiss may propagate across the plasmapause boundary to lower latitudes and become subsequently reflected and trapped within the plasmasphere. Measurements indicate that at least part of the VLF hiss which is observed by the Injun 5 satellite must be generated above the Injun 5 altitude range. A new type of subauroral zone VLF hiss was observed called mid-latitude hiss. Author

N70-37112# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ON THE POTENTIAL OF MICROWAVE TO MILLIMETER WAVE SEMICONDUCTOR PHASE-SHIFTING FOR INERTIALESS ANTENNA SCANNING OF MOUNTED ANTENNAS
Eugene A. Graham 1969 11 p refs Presented at the IEE and IEEE European Conf. on Microwaves, London, 8–12 Sep. 1969 Submitted for publication
(ONERA-TP-778) Avail: CFSTI

Inertialess scanning of antennas at millimeter wave frequencies is essential for certain sophisticated commercial, scientific, and military uses and certain applications involving the mounting of antennas on space vehicles, require properly scanned antennas mated to radiometric or similar sensing systems for automatic space exploration as well as for guidance-orientation. Such antennas must be lightweight and incorporated in the limited available space. The class of antenna system considered in this report is attractive because of the exceedingly small amounts of control power necessary. There are added advantages because of the possibilities of meeting overall system requirements of the antenna subsystem through variations of possible configurations and combinations of such antenna subclasses. Author (ESRO)

N70-37198# New Mexico State Univ., University Park. Physical Science Lab.
EVALUATION OF FDM-FM MODULATION FOR USE ON WAYSIDE COMMUNICATION SYSTEMS Final Report, 17 Jun. 1969–12 Jan. 1970
Mar. 1970 128 p
(Contract DOT-FR-9-0026)
(PB-191788; PSL-PE00651; FRA-RT-70-37) Avail: CFSTI CSCL 17/B

The frequency response of long transmission line with multiplex reflection discontinuity is obtained by computer simulation. A criterian is derived for evaluating frequency division multiplex on a frequency modulation carrier for transmission over the simulated lines. Author (USGRDR)

N70-37227*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A BINARY CODED SEQUENTIAL ACQUISITION RANGING SYSTEM
W. L. Martin *In its* Sci. Appl. of Radio and Radar Tracing in the Space Program 1 Jul. 1970 p 3–13 refs (See N70-37226 20-30)
Avail: CFSTI CSCL 17I

Utilization of spacecraft Doppler to provide a synchronous model of the received signal is discussed. The correlation properties of binary codes, as well as the resultant simplifications of the spacecraft regenerative transponder (necessary for very deep space probes) are received. Brief mention is made of the integrated circuit packaging scheme that yielded a twentyfold reduction in system size together with a concomitant increase in reliability. The system accuracy, its relationship to the hardware, and a description of the data output and its meaning to the user are considered. Author

N70-37228*# Smithsonian Astrophysical Observatory.
INVESTIGATIONS OF VERY LONG BASELINE INTERFEROMETRY AT SMITHSONIAN ASTROPHYSICAL OBSERVATORY
R. D. Michelini *In* JPL Sci. Appl. of Radio and Radar Tracking in the Space Program 1 Jul. 1970 p 15–26 refs (See N70-37226 20-30)
Avail: CFSTI CSCL 17H

Ideas and work preparation are described for several very long baseline interferometry (VLBI) experiments. The possibilities of augmenting laser and optical satellite tracking techniques with VLBI methods to refine geophysical measurements are discussed. Some developing ideas on the potential of conducting independent clock interferometry experiments with a global and easily transportable network of receiver terminals are also presented. Author

N70-37229*# Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE HAYSTACK PLANETARY RANGING RADAR
J. V. Evans, R.P. Ingalls, and G. H. Pettengill *In* JPL Sci. Appl. of Radio and Radar Tracking in the Space Program 1 Jul. 1970 p 27–36 refs Supported by AF (See N70-37226 20-30)
Avail: CFSTI CSCL 17I

The Haystack 3.8-cm wavelength continuous wave radar system is described. The radar was employed routinely for observations of the Moon, Mercury, Venus, and Mars. By virtue of the high operating frequency, increased transmitter power, and reduced system temperature, the sensitivity of this instrument exceeds that of earlier planetary radar systems at 23- and 68-cm wavelength by as much as 36 dB. A description of the apparatus, an account of the coding scheme employed for making range measurements, and the data processing procedures for optimally determining the best estimate of the range and velocity of the planet rear surface are given. Author

N70-37230*# Arecibo Ionospheric Observatory, Puerto Rico.
APPLICATION OF A MODEL FITTING PROCEDURE TO THE DETERMINATION OF UNKNOWN PARAMETERS IN SEVERAL THEORETICAL BACKSCATTER MODELS OF VENUS AT 70-cm WAVELENGTH
R. F. Jurgens *In* JPL Sci. Appl. of Radio and Radar Tracking in the Space Program 1 Jul. 1970 p 43–49 refs Sponsored by Cornell Univ., ARPA, and NSF (See N70-37226 20-30)
Avail: CFSTI CSCL 17I

A procedure of model fitting was applied to the determination of the backscatter characteristics of Venus using the radar observations at 70-cm wavelength made during the inferior conjunction of 1967. The principle of weighted least squares was used to minimize the rms error between the observed echo power as a function of delay and a model echo based on the convolution of the radar ambiguity function and several theoretical backscatter models by adjusting the arbitrary parameters in the models. Several backscatter models which were found to fit the lunar radar observations over a wide range of incidence angles were tested. Results of the procedure indicate that the backscatter law of Venus is variable depending upon the locations of certain surface features, and that these surface features contribute significantly to the backscattered power for a given delay annulus if the angle of incidence is large. Therefore, certain models which attempt to extract physical information about the roughness of the bulk of the surface of Venus are likely to be strongly biased by the surface features. Data are presented. Author

N70-37246# Texas Univ., Austin. Antennas and Propagation Div.
EVALUATION OF A METHOD FOR OBTAINING SIGNAL ATTENTUATION FROM BACKSCATTER MEASUREMENTS
M. S. Fowler and A. H. La Grone 2 Feb. 1970 15 p refs
(Grants NSF GA-772; NSF GA-11462)
(PB-190161; P-42) Avail: CFSTI CSCL 17B

The effects of variations in the drop size distribution function on theoretically relating radar backscatter at one frequency to attenuation at the same frequency and at other frequencies is investigated. The effects are found to be essentially negligible at frequencies near the reference frequency. At frequencies approximately one decade above the reference frequency, the difference in the predicted attenuation and that computed from a measured drop size distribution in an actual rain shower is 1.34 dB. The predicted attentuation is lower. Author (USGRDR)

N70-37270# Texas Univ., Austin. Antennas and Propagation Div.
ESTIMATING ATTENTUATION THROUGH PRECIPITATION FROM RADAR ECHO
M. S. Fowler and A. H. La Grone 26 Jan. 1970 28 p refs
(Grants NSF GA-772; NSF GA-11462)
(PB-190162; P-41) Avail: CFSTI CSCL 17A

The backscattered cross section and absorption cross section of spherical drops of liquid water are determined for various drop sizes, temperatures and frequencies. The drop cross sections are used to determine the backscattered cross section and the attenuation cross section for precipitating volumes having assumed Marshall-Palmer drop size distributions. The backscattered cross section for a signal that is not significantly attenuated is theoretically related to the attenuation cross section of a signal that is attentuated. Curves are drawn relating the backscattered cross section at 3.3 GHz to the attenuation cross section for 9.068, 15, 18, and 36 GHz. Author (USGRDR)

N70-37285# Royal Aircraft Establishment, Farnborough (England).
OBSERVATION LIMITS OF LOW POWER SPACEBORNE SIDE-LOOKING RADAR FOR EARTH RESOURCES APPLICATIONS
S. L. Entres Jan. 1970 19 p refs
(RAE-TR-70015) Copyright. Avail: CFSTI

Some observational capabilities of orbiting side-looking synthetic aperture radar systems are evaluated. Two mean radar power levels are assumed available, 250 W and 500 W, and observation from 500 km and 1000 km altitude respectively is considered. A ground resolution distance of about 50 m associated with an observed strip about 100 km wide seems feasible though radar wavelengths required tend to become long. Author (ESRO)

N70-37402*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
Ku BAND TRACKING AND DATA RELAY SATELLITE GROUND ANTENNA STUDY
Leonard F. Deerkoski, Howard Estep, Paul A. Lantz, and Nicholas A. Raumann Jun. 1970 155 p refs
(NASA-TM-X-65313; X-525-70-200) Avail: CFSTI CSCL 09E

An array of four 42-foot diameter reflector antennas on a single pedestal is the most attractive ground antenna configuration to provide the 70 db gain required for the 16 GHz Tracking and Data Relay Satellite (TDRS) to ground communication link. A continuous uninterrupted communication channel precludes the use of a radome beause of water film losses under precipitation. A 17-foot diameter acquisition antenna at the center of the array enables the system to acquire and track the TDRS within a 1/4 degree cone about the boresite axis of the full array. The acquisition antenna can also be used for command uplink to the TDRS while simultaneously tracking and receiving with the full array. Author

N70-37427*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MINITRACK POSTDETECTION BANDWIDTH CONSIDERATIONS
T. J. Grenchik and C. W. Murray, Jr. Jun. 1970 103 p refs
(NASA-TM-X-65311; X-551-70-171) Avail: CFSTI CSCL 09D

A description of the Minitrack system and definition of the measurement made by the system is presented. Design considerations relating to the phaselock loop response of the proposed postdetection filter are discussed. Under an assumed set of worst case orbital dynamics for the satellite (100 statute mile height circular orbit with a useful 10 deg overhead arc), a second order phaselock loop with a 10 Hz bandwidth is recommended for the filter. The gain due to least squares smoothing of the Minitrack data at the output of the postdetection filter is calculated for a number of filter designs. For the 10 Hz equivalent double pole filter above, a sampling rate from 10 to 20 samples per second is recommended. It is shown that by increasing the rate above 20 samples per second the gain due to smoothing increases by approximately 1 db, while aggravating the data handling problem. Author

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N70-36228# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PRINCIPLES OF AUTOMATIC DETECTION OF MALFUNCTIONS IN DIGITAL COMPUTERS
S. G. Denisov et al 25 Feb. 1970 11 p refs Transl. into ENGLISH from the Russian
(AD-704001; FTD-HT-23-39-70) Avail: CFSTI CSCL 9/2

In practice, the computer is subdivided into several units (storage, arithmetic unit, control unit, input-output), and each unit is checked separately. Program search for faults is based on a step by step expanding regions principle. The checking of each element of a digital computer is conducted in the same sequence in which the computer input is normally processed. Author (TAB)

N70-36270# Naval Postgraduate School, Monterey, Calif.
A DIGITAL COMPUTER PROGRAM FOR DETERMINING THE FREQUENCY RESPONSE OF A LINEAR SYSTEM TO A SINUSOIDAL EXCITATION
Richard Owen Allen, Jr. (M.S. Thesis) Dec. 1969 48 p refs
(AD-703230) Avail: CFSTI CSCL 9/2

The application of digital computers for the simulation of physical systems has become widespread. This paper describes a program designed to measure the frequency response of the simulation model of a linear system. Author (TAB)

N70-36349# Illinois Univ., Urbana. Dept. of Electrical Engineering.
NOTATION OF MOVEMENT Final Report, 1 Mar. 1968 - 31 Aug. 1969
Noa Eshkol, Peter Melvin, Jean Michl, Heinz von Foerster, and Abraham Wachmann 15 Feb. 1970 183 p refs
(Grant DA-ARO(D)-31-124-G998)
(AD-703936; AROD-7875-1-RT) Avail: CFSTI CSCL 6/4

First, the basic principles of a notation of bodily movements as developed by Noa Eshkol and Abraham Wachmann are summarized. The syntactic elements of this notation are then translated into equations of motion in a set of Cartesian coordinate systems each of which is associated with a movable part of the body. Hence, by a cascade of transforms, any desired (and executable) movement is now describable. A computer program has been

written which carries out these transformations, thus, any movement prescribed by a sequence of symbols in Eshkol-Wachmann notation can now be represented by the appropriate trajectories which, in this program, are printed out with a CALCOMP plotter as projections into the three principal planes, the XY-plane, the YZ-plane and the ZX-plane. Numerous illustrations exemplify the rich possibilities of an algorithm which translates symbolic commands into effective movements. Author (TAB)

N70-36368*+ Stanford Univ., Calif. Remote Sensing Lab.
THE 1969/1970 STANFORD SPECTRAL DATA MANAGEMENT SYSTEM: INFRARED SPECTROMETRY STUDIES
Michael Heathman Jun. 1970 114 p refs
(Contract NAS9-7313)
(NASA-CR-108584; SU-RSL-TR-70-11) Avail: CFSTI CSCL 09B

A report is presented on the data analysis system used to read in, modify, and reduce the data obtained from both the NASA IR airborne spectrometer and the SG-4 field spectrometer. Sections are included covering the general overview of the system, data flow and formats within the system, program explanations, and specific program-use instructions. The appendices contain system flow diagrams, references, program listings, and example program runs. Author

N70-36401# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ORGANIZATION OF COMMUNICATION IN INFORMATION SYSTEMS
V. P. Datsenko et al 4 Nov. 1969 22 p refs Transl. into ENGLISH from the Russian
(AD-703160; FTD-MT-24-199-69) Avail: CFSTI CSCL 5/2

Organization of communications between the center of an automated system of information exchange and the subscribers to the system is described. There are three requirements. First, those technical communication means must be chosen which will provide effective and convenient avenues for cals from the subscribers to the center; second, the required equipment system must be determined on the basis of a technical and economical analysis; third, the amount of equipment of a single type must be computed depending on the system load. These three problems are considered in this article. Author (TAB)

N70-36405# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROBLEMS OF PROGRAMMING AUTOMATION IN THE ESTONIAN SSR
B. Tamm 4 Oct. 1969 33 p refs Transl. into ENGLISH from Ser. Fiz., Mat. (SSSR), v. 16, no. 3, 1967 p 267–285
(AD-700464; FTD-HT-23-404-68) Avail: CFSTI CSCL 9/2

The primary purpose of the studies reported in the paper was to develop automatic programming systems using algorithmic languages of higher levels and translators which would make it possible to realize on small electronic computers any algorithm written in a corresponding language. A basic trend has been toward the development of ALGOL-type systems. The problem was reduced to the determination of an ALGOL subset on the basis of which it would be possible to solve a wide class of problems, to simplify the structure and syntax of the language, and to realize a corresponding translator using small Minsk- and Ural-type computers. The MALGOL system was proposed which satisfied the above-mentioned requirements; it has been used primarily on the M-3, Minsk-2, and Minsk-22 computers. The paper describes the MALGOL peculiarities and points out the differences between it and the ALGOL system. TAB

N70-36406# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SMALL CALCULATORS
22 Oct. 1969 12 p Transl. into ENGLISH from Inform. Byul. Vystavka Dostizhenii Narodnogo Khozyaistva SSR, no. 6, 1968 p 11–12
(AD-703154; FTD-MT-24-255-69) Avail: CFSTI CSCL 9/2

The paper describes the types and applications of small calculators and summarizes the performance specifications of some Russian machines. (1) SDM-107 - an adding machine, 140 operations per minute, ten place numbers, motor-driven, adds, subtracts; (2) Felix - a lever arithmometer, non-automatic, multiplies, divides, adds, subtracts, thirteen place numbers, manual operation; (3) VK-1 - a ten key, non-automatic machine for multiplication and division; (4) VK-2 - a semi-automatic machine in which only the division is carried out automatically; (5) VK-3 - a fully automatic calculator capable of adding, subtracting, multiplying and dividing; (6) VMM-2 - a multi-key calculator capable of the four basic and some auxilliary mathematical operations, processes 17 digit numbers, motor driven; (7) desk top relay calculators Vyatka and Vilnyus, four basic operations, exponentiation, multiplication with subtraction, multiplication with addition, difference and sum of products, difference of squares of two numbers, automatic operation, 300 cycles per minute, 18 place numbers. TAB

N70-36427*# Electronic Memories, Inc., Hawthorne, Calif.
THE SEMS 5L CORE MEMORY SYSTEM Final Project Report, Apr. – Nov. 1969
Dec. 1969 290 p refs
(Contract NAS5-11183)
(NASA-CR-112404) Avail: CFSTI CSCL 09B

A description and analysis of work accomplished in the design, construction, and testing of one qualification model of the Random Access Memory System are presented. Theory of operation, reliability analysis, test programs, and recommendations for the memory are included. Additional relevant information is appended. Author

N70-36455# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INPUT LANGUAGE AND ADDRESS TRANSLATOR FOR THE DIGITAL COMPUTER MINSK-12
G. E. Kuzmenko et al 4 Mar. 1970 15 p refs Transl. into ENGLISH from Dokl. Avtomatiz. Programmirovaniya (USSR), no. 2, 1967 p 58–67
(AD-703784; FTD-HT-23-113-70) Avail: CFSTI CSCL 9/2

The input language of the address translator is based on the following symbols: fundamental symbol - letter, numeral, mark. Letters of the Russian, Latin, and Greek alphabets are used. The letters serve to form the identifiers of addresses, marks, and functions. Numerals are used to produce constants, codes, and identifiers of addresses and marks. The input language permits formation of the following operators: conveying, transfer, entering a subroutine, nonstandard operator, and cycling. These operators are detailed. TAB

N70-36458# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AUTOMATION AND COMPUTER TECHNOLOGY, NO. 1, 1968: SELECTED ARTICLES
Kh. L. Vanga et al 3 Mar. 1970 33 p refs Transl. into ENGLISH from Avtomat. Vychisl. Tekh. (Latvian SSR), No. 1, 1968 p 31–36, 61–89
(AD-703783; FTH-HT-23-40-70) Avail: CFSTI CSCL 9/2

Contents: Deriving initial diagnostic data for a finite automaton; and Neuristor adders. TAB

N70-36466# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
LIBRARY PROGRAMS FOR THE AECL G-20/3100 COMPUTER, PART A, ADDENDUM 2
N. R. Burnham Nov. 1969 58 p
(PB-188663; AECL-1744-Pt-A-Add-2; CRT-1149-Pt-A-Add-2)

Avail: CFSTI CSCL 09B

The report gives descriptions of computer programs added to the library file for the G-20/3100 computer since the last report. The programs listed include mathematical analysis and input output routines. USGRDR

N70-36517# Naval Research Lab., Washington, D.C.
A FORTRAN PROGRAM TO TRANSLATE TELETYPE PAPER TAPE CODE TO CDC-3800 HOLLERITH CODE Final Report
James A. Buisson, III 16 Mar. 1970 12 p
(AD-705055; NRL-MR-2108) Avail: CFSTI CSCL 9/2

A technique has been devised to translate data from teletype punched paper tape to Hollerith cards. The use of such a technique is of importance to all persons using some type of teletype terminal (time-share, etc.) in conjunction with a larger computer installation. Author (TAB)

N70-36519# Naval Research Lab., Washington, D.C.
THE 813 DISK FILE SUBROUTINE PACKAGE Final Report
Edward L. Aiken, Dianna L. Denton, and Douglas P. Shannon Feb. 1970 21 p refs *Its* NRL Computer Bull. No. 19
(AD-705054; NRL-MR-2104) Avail: CFSTI CSCL 9/2

Several subroutines have been written in COMPASS for the CDC 3800 computer to allow permanent and temporary storage on the 813 disk file. Access to such storage can be either in a random or sequential manner. Author (TAB)

N70-36521# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ANALOG AND DIGITAL-ANALOG COMPUTER TECHNIQUE; COLLECTION OF ARTICLES: SELECTED ARTICLES
A. E. Stepanov et al 26 Mar. 1970 25 p refs Transl. into ENGLISH from Sb. Statei (USSR), no. 2, 1968 p 202–209, 258–267
(AD-705262; FTD-HT-23-81-70) Avail: CFSTI CSCL 9/2

Contents: The Alfa (EMSS-8 specialized computer; and Principal applications of thyristors in computer technology. TAB

N70-36544# System Development Corp., Santa Monica, Calif.
AUTOMATION: SOME PIONEERING MILITARY APPLICATIONS
David C. Phillips Jan. 1970 43 p refs
(AD-704862; SDC-SP-3465) Avail: CFSTI CSCL 9/2

The diversity of computerized systems is examined, with emphasis upon innovative applications by the military services. The limitations and the advantages of computers are highlighted in an attempt to determine the extent to which man has reacted to this technical revolution. Author (TAB)

N70-36548# RAND Corp., Santa Monica, Calif.
JOSTRAN: AN INTERACTIVE JOSS DIALECT FOR WRITING AND DEBUGGING FORTRAN PROGRAMS
W. R. Graham and D. C. MacNeilage Mar. 1970 14 p refs
(Contract F44620-67-C-0045)
(AD-704568; RM-6248-PR) Avail: CFSTI CSCL 9/2

The document gives a description of JOSTRAN, a JOSS dialect that expedites the construction of FORTRAN programs. JOSS is an interactive, on-line computer system. JOSS-language programs are list-processed; i.e., each statement is interpreted at execution time. FORTRAN is the principal language for programming digital computers to perform numerical calculations. The JOSS language permits greater flexibility and subtlety, but FORTRAN can handle larger calculations. JOSTRAN, a specified FORTRAN-compatible dialect of JOSS, combines the advantages of both languages. It allows the user to exploit JOSSs interactive, list-processing facilities while writing and debugging a program, and facilitates the translation of the JOSTRAN program into FORTRAN. TAB

N70-36550# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COMPLEX COMPUTER MODELLING SYSTEM
N. M. Sotskiy 27 Oct. 1969 15 p Transl. into ENGLISH from Sredstva Analogovol i Analogo-Tsifrovoi Vychislitelnoi Tekhn. (Moscow), 1968 p 190–196
(AD-700411; FTD-MT-24-215-69) Avail: CFSTI CSCL 9/2

The paper describes a system combining analog and digital computers, which is designed to use the best features of each type of computer for the modeling of complex design and control problems. Generally, high-speed calculations which require only limited accuracy are assigned to the analog machines, and the precise but slower-speed operations are done by the digital machines. The main elements are: two digital computers, a matching unit, a digital timing unit, a central dispatcher-converter, the user dispatcher-converters, and analog computers with their converters. TAB

N70-36562# Michigan Univ., Ann Arbor. Cooley Electronics Lab.
CPS PROGRAM LOGIC MANUAL VOLUME 1: CPS SYSTEM ARCHITECTURE AND CONVENTIONS
G. N. Cederquist and K. Metzger Feb. 1970 227 p refs
(Contract Nonr-1224(36))
(AD-705492; TM-102-1; Rept-03674-23-M-Vol-1) Avail: CFSTI CSCL 9/2

The Cooley Programming System (CPS) is a generalized programming and file management system written for use on the PDP-8 processor of Digital Equipment Corporationss LINC-8 computer. A minimum memory size of 8192 words is required. Extensive use is made of the two tape units present on every LINC-8 for both file storage and system residence. The four volumes entitled CPS System Architecture and Conventions, CPS Basic Programming Package, CPS 8-K FORTRAN Package, and CPS System Utility Programs were written in order to take a snapshot of CPS at one point in its continuing development. This version of CPS is considered to be a first generation system; successive versions are on the drawing boards and internally resemble their parent less and less every day. The present document, Volume 1, describes the system structure and conventions. Author (TAB)

N70-36563# Michigan Univ., Ann Arbor. Cooley Electronics Lab.
CPS PROGRAM LOGIC MANUAL VOLUME 3: CPS 8-K FORTRAN PACKAGE
G. N. Cederquist and K. Metzger Dec. 1969 152 p
(Contract Nonr-1224(36))
(AD-705494; TM-102-3; Rept-03674-23-M-Vol-3) Avail: CFSTI CSCL 9/2

CPS is a generalized programming and file management system written for use on the PDP-8 processor of DDigital Equipment Corporations LINC-8 computer. A minimum memory size of 8192 words is required. Extensive use is made of the two tape units present on every LINC-8 for both file storage and system residence. The four volumes entitled CPS System Architecture and Conventions, CPS Basic Programming Package, CPS 8-K FORTRAN Package, and CPS System Utility Programs were written in order to take a snapshot of CPS at one point in its continuing development. This version of CPS is considered to be a first generation system; successive versions are on the drawing boards. The present document, Volume 3, describes the modifications and support routines which were added to DECs 8-K FORTRAN system in order to allow it to interface with CPS. Author (TAB)

N70-36564# Michigan Univ., Ann Arbor. Cooley Electronics Lab.
CPS PROGRAM LOGIC MANUAL VOLUME 4: CPS SYSTEM

UTILITY PROGRAMS
G. N. Cederquist and K. Metzger Dec. 1969 57 p
(Contract Nonr-1224(36))
(AD-705493; TM-102-4; Rept-03674-23-M-Vol-4) Avail: CFSTI CSCL 9/2

CPS is a generalized programming and file management system written for use on the PDP-8 processor of Digital Equipment Corporations LINC-8 computer. A minimum memory size of 8192 words is required. Extensive use is made of the two tape units present on every LINC-8 for both file storage and system residence. The four volumes entitled CPS System Architecture and Conventions, CPS Basic Programming Package, CPS 8-K FORTRAN Package, and CPS System Utility Programs were written in order to take a snapshot of CPS at one point in its continuing development. This version of CPS is considered to be a first generation system; successive versions are on the drawing boards. The present document, Volume 4, contains the user descriptions and program listings of four CPS utility programs and two LINC-tape read/write routines. Author (TAB)

N70-36576# Naval Postgraduate School, Monterey, Calif.
A PROPOSED PROGRAMMING SYSTEM FOR KNUTH'S MIX COMPUTER
Max Neil Akers (M.S. Thesis) Jun. 1969 105 p refs
(AD-705101) Avail: CFSTI CSCL 9/2

A programming system using a hypothetical computer is proposed for use in teaching machine and assembly language programming courses. Major components such as monitor, assembler, interpreter, grader and diagnostics are described. The Interpreter is programmed and documented for use on an IBM 360/67. The interpreter can be used for teaching machine language programming and can be incorporated into the proposed programming system. Author (TAB)

N70-36687# European Atomic Energy Community, GEEL (Belgium). Central Bureau for Nuclear Measurements.
THE THREE-DIMENSIONAL PLOTTING PROGRAM TRICE
G. Nastri and C. Cervini Jun. 1970 46 p refs
(EUR-4484.e) Avail: CFSTI

The program TRICE (FORTRAN 4 IBM 1800) projects a surface on a plane from a given observation point and plots the projected surface without hidden points. Author

N70-36690*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPACE SCIENCES DATA-HANDLING AND MISSION OPERATIONS
George H. Ludwig *In its* Opt. Telescope Technol. 1970 p 103–112 (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 09B

Ground processing of very large volumes of data that are telemetered from modern spacecraft takes place in real-time and near real-time operations in the control center. The present state-of-the-art in ground processing technology is outlined and new desirable techniques are projected. It is shown that data will have to reach the experimenters from orbiting telescopes accurately and rapidly; some of it almost immediately, some of it within a day, and most of it within a week to insure proper data flow. A high density storage system is desirable for recording digital data in optical form on film chips to provide a total on-line volume of from 10 to the 10th power to 10 to the 12th power bits. G.G.

N70-36750*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ONBOARD COMPUTER FOR ORBITING ASTRONOMICAL OBSERVATORY MISSION
Ronald M. Muller *In its* Opt. Telescope Technol. 1970 p 693–697 (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 09B

A general purpose computer for an orbiting astronomical observatory is described and its major design requirements are discussed. The advantages of an onboard computer over an all-hardware spacecraft are considered with respect to permitting communication between the individual components of the spacecraft and to equal time-sharing during experiments. R.B.

N70-36783*# Martin Marietta Corp., Denver, Colo.
FLIGHT PACKAGED ONBOARD CHECKOUT SYSTEMS DEVELOPMENT UNIT. SOFTWARE DOCUMENTATION, OVERALL SPECIFICATION, LEVEL 2: TEST ORIENTED ONBOARD LANGUAGE SYSTEM (TOOL)
18 Mar. 1970 60 p revised
(Contract NAS9-8000)
(NASA-CR-112347; MCR-69-192-Rev-2) Avail: CFSTI CSCL 09B

Test Oriented Onboard Language (TOOL) has as its purpose the translation and editing of test sequences, translation consisting of converting operator keyboard inputs, or responses to displayed cues, into a test sequence data list, and execution of the translated test sequences, accomplished by a set of test element processors. The test language is described, including its organization structure; sequence translation, initiation, and execution; resource allocation; control and alphanumeric display unit; test protection, and identification procedures. Detailed descriptions of the TOOL elements follow which are examples for the Off-Line/Translator. P.A.B.

N70-36789*# Maryland Univ., College Park. Computer Science Center.
AN IOCS ALGORITHM FOR MICROPROGRAMMING
Jeffry W. Yeh Jul. 1970 119 p refs
(Grant NGR-21-002-206)
(NASA-CR-112367; TR-70-124) Avail: CFSTI CSCL 09B

An Input-Output Control System (IOCS) initiates and controls the input and output processes of an operating system, thereby making it unnecessary for the user to recode any of these processes. Presented is a tree-structure design of an IOCS, using double-buffers. The design includes a set of macro instructions and a set of algorithms. There are three levels in the tree-structure: the first level deals with file handling and buffering; the second level with I/O scheduling; and the third level with the device drivers. Special emphasis is placed on the design of the file and on buffering, employing double buffers for files, variable lengths for buffers, and a rotation method for buffer usage. All algorithms are presented in the form of flow charts, including an overall flow chart for the IOCS and 16 flow charts for individual algorithms. The purpose, the major objectives, the input and output, as well as the calling sequences, are stated for each flow chart. Author

N70-36784*# West Virginia Univ., Morgantown. Endocrine Lab.
[LAP6/WVU SYSTEM OUTLINE]
Clyde G. Roby, Jr. 4 Mar. 1970 24 p
(Grants NGR-49-001-019; USPH-5-R01-AM04577; Contract Nonr-101-441)
(NASA-CR-112683) Avail: CFSTI CSCL 09B

LAP6/WVU is designed to take advantage of the additional 1024 words of memory available on the basic LINC-8 or PDP-12. The extra memory has been used to add: (1) character by character deletion during the editor mode which facilitates the preparation of input data as well as program manuscripts; (2) eight character symbolic names of which there can be a maximum of 192; (3) tape identification; and (4) a date which is available for listings. A high speed version of LAP6/WVU has been developed

in which the LAP6/WVU system resides on a disk. This system requires an 8K LINC-8 with at least 64K of disk storage. This manual was designed to function as a supplement to the LAP6 HANDBOOK and assumes that the user has a copy of it available. Author

N70-36873# Pennsylvania Univ., Philadelphia. Moore School of Electrical Engineering.
DESIGN CONSIDERATIONS FOR A LARGE COMPUTING SYSTEM WITH A GEOGRAPHICALLY DISPERSED DEMAND
Richard Peebles Mar. 1970 35 p refs
(Contract N00014-67-A-0216-0007)
(AD-702759; Rept-70-21) Avail: CFSTI CSCL 9/2

The report identifies the principal issues in choosing a design for a large data processing system with a geographically dispersed computing demand. Three approaches are described, centralization, decentralization, and distributed networks. Author (TAB)

N70-36890*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Astrionics Div.
DATA HANDLING SYSTEMS
In its Space Programs Sum. No. 37-62, Vol. 3 30 Apr. 1970 p 203-211 refs (See N70-36876 20-34)
Copyright. Avail: CFSTI CSCL 09B

A quasi-linear model of digital record/reproduce process of magnetic tape recorders is discussed. A driver circuit is described for interfacing between transitor-transistor logic and field effect transistor switching trees. The basic and redundant circuits were breadboarded and tested with discrete components. The redundant driver was also fabricated on 1 × 1 in. substrate utilizing hybrid chip capacitors, leadless inverted semiconductors, and thick film resistors and wiring. A full-sized tree system for 384 sensors incorporating nine hybrid driver units is being constructed. J.A.M.

N70-36915*# Stanford Univ., Calif. Digital Systems Lab.
ANALYSIS AND SYNTHESIS OF CONCURRENT SEQUENTIAL PROGRAMS
Thomas H. Bredt May 1970 52 p refs
(Grant NGR-05-020-337; Contract N00014-67-A-0112-0044)
(NASA-CR-112674; SU-SEL-70-024; STAN-CS-70-170; TR-6) Avail: CFSTI CSCL 09B

Analysis and synthesis procedures are presented for a class of sequential programs. These procedures aid in the design of programs for parallel computer systems. In particular, the interactions of a given program with other programs or circuits in a system can be described precisely. The basis for this work is a model for parallel computer systems in which the operation of each component is described by a flow table and the components interact by changing in values on interconnecting lines. The analysis procedure produces a flow table description of a program. In program synthesis, a flow table description is converted to a sequential program. Using flow table design procedures, a control program for the two-program mutual exclusion problem is produced. Author

N70-36979# California Univ., Livermore. Lawrence Radiation Lab.
DESCRIPTION OF THE TENSOR-PUFL FORTRAN PROGRAM
Leota K. Barr 19 Jan. 1970 16 p refs
(UCRL-50801) Avail: CFSTI

Two finite-difference calculations (codes) are linked along a common boundary where each supplies the other with a boundary condition. One code (TENSOR) uses a pressure vs time and position boundary condition and supplies the other code (PUFL) with a displacement vs time and position boundary condition. A description is given to the TENSOR-PUFL link FORTRAN program. A detailed outline of the calculations, the logical flow of the linkage, and lists of PUFL input parameters are given. Author (NSA)

N70-36997# AEG-Telefunken, Konstanz (West Germany).
SYSTEM DESIGN FOR AN AEROSPACE DIGITAL COMPUTER [SYSTEMKONZEPT EINES BORDRECHNERS FUER RAUMFLUGKOERPER]
C. Habenicht, L. Hohnberg, R. Klett, B. Maag (Dornier System G.m.b.H.), M. Schymanietz et al Apr. 1970 320 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-FB-W-70-11) Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 67.20 DM

The state of the art in the field of aerospace digital computers is discussed. The aims of known projects are analyzed and, in certain field areas, are discussed in detail and computer requirements are listed. Onboard data processing comprises mainly acquisition, compression, output and transmission of data. A system philosophy for the division of facilities is presented. According to a rough design the computer contains data, instruction and microprogram memories, and the possibilities of implementation are investigated. The components of the computer are selected by comparing characteristics. A construction technique with thick film and flexible printed wiring results in a proposal for compact construction. Author (ESRO)

N70-37011# Office for Scientific and Technical Information, Manchester (England). Documentation Processing Centre.
COMPUTER TYPESETTING IN THE U.K.: A REVIEW
H. J. Davis Nov. 1969 25 p refs *Its* DPC Inform. Display Proj. Rept. No. 1
(OSTI/DPC-4001) Avail: CFSTI

This paper reviews U.K. computer typesetting projects with emphasis on the use of data originating from a computer rather than from a printing environment. It explains the need for an alternative to the computer line-printer when large amounts of data are being processed, and the effect of new techniques on the printing industry. A selection of current and potential applications illustrate the range and volume of possible development. The use of data banks to provide a source of copy for the production of varied publications is discussed and an estimate of future trends is offered. Author (ESRO)

N70-37020# Los Alamos Scientific Lab., N. Mex.
COMPUTER CODES FOR PRESENTATION, INTERPOLATION, AND INTEGRATION OF TWO-PARAMETER DATA
Barry K. Barnes and W. Mort Sanders 3 Apr. 1970 25 p refs
(Contract W-7405-eng-36)
(LA-4326) Avail: CFSTI

Three computer codes and their associated subroutines are described for the handling and presentation of data taken as a function of two coordinates. Interpolatory cubic spline functions are used to interpolate irregularly spaced data points to obtain regularly spaced data. Spline functions are also used to integrate the volume under the surface formed by the data. Presentation of the data is made either as an isometric projection plot or as a density plot. These two forms of presentation are compared with each other and with contour plots. Author (NSA)

N70-37134# Office for Scientific and Technical Information, Manchester (England). Documentation Processing Centre.
A SELECTED BIBLIOGRAPHY OF ON-LINE VISUAL DISPLAYS AND THEIR APPLICATIONS
J. Braidwood Dec. 1969 53 p refs *Its* DPC Inform. Display Proj. Rept. No. 2
(OSTI/DPC-4002) Avail: CFSTI

This bibliography covers general principles and problems of information display, man-computer interaction, present and possible future display equipment, ergonomic aspects of display design, and current and potential applications to information processing. Author (ESRO)

N70-37176# Georgia Inst. of Tech., Atlanta. School of Information Science.

A SURVEY OF BULK STORAGE TECHNOLOGY

Kay A. Mowery 1969 39 p refs

(Grant NSF GN-655)

(PB-189620; GITIS-69-21) Avail: CFSTI CSCL 9/2

A comprehensive survey and organization of the field of bulk storage is presented. Equipment organizations and media are cataloged. Device characteristics for bulk core storage and large-capacity cartridge stores are presented. Concepts of evaluation, selection and utilization are discussed. Author (USGRDR)

N70-37185# Eidenossische Technische Hochschule, Zurich (Switzerland).

MODEL-ADAPTIVE SYSTEMS [MODELLADAPTIVE SYSTEME]

Walter Schaufelberger (Ph.D. Thesis) 1969 160 p refs In GERMAN; ENGLISH summary

(Diss-4208) Avail: CFSTI

The study and design of fast model-adaptive systems are presented. The theoretical aspects are given and are based on the definition of a model-adaptive system. The pseudogradient method has some disadvantages because of the assumption of a constant control vector. Introducing the local gradient takes into consideration the time behavior of the control vector and increases the dynamical behavior of the adaptive system. The two gradient methods are compared with a compensation method. In the compensation method the poles and zeroes of the plant are compensated such that the model differential equation is obtained. For the identification required for the compensation a new method with linear filters is derived. Author

N70-37199# Nebraska Univ., Lincoln. Agricultural Experiment Station.

COMPUTER PROGRAM FOR PLOTTING TIME DEPENDENT DATA WITH INSTRUCTION AND EXAMPLES

K. W. Brown and Norman J. Rosenberg Jul. 1969 34 p

(PB-191870; MP-23; W70-01008; OWRR-A-001-NEBR(4)) Avail: CFSTI CSCL 09B

A computer program was developed to plot time dependent data from a storage matrix. The body of the program, entitled TIMEPLOT, is written in FORTRAN 4. To minimize the run time required, the input and output subroutines are written in F level COBOL. Time, which may range from 1 hour to 16 days, is plotted on the abscissa. The program computes the intervals at which labels are placed and determines the required annotation. Data may be plotted as frequently as one observation per minute or as infrequently as one observation per day. The ordinate may represent any parameter. A single parameter may be plotted or several parameters may be superimposed upon each other. Combinations may be arranged on a single time axis. The program was designed with special features to facilitate the plotting of microclimatic, micrometeorological, and other types of time dependant data. Author (USGRDR)

N70-37214# National Bureau of Standards, Washington, D.C. Office of Information Processing Standards.

IMPLEMENTATION OF THE CODE FOR INFORMATION INTERCHANGE AND RELATED MEDIA STANDARDS: HARDWARE STANDARDS IN INTERCHANGE CODES AND MEDIA Final Report

Harry S. White, Jr. 7 Mar. 1969 18 p refs

(PB-191999; FIPS-PUB-7) Avail: SOD $0.25; CFSTI CSCL 09B

The Federal Information Processing Standards (FISP) Publication provides further details covering the implementation of the Code for Information Interchange (FIPS 1), Perforated Tape Code for Information Interchange (FIPS 2), and Recorded Magnetic Tape Code for Information Interchange (800 CPI, NRZI) (FIPS 3). The publication includes a letter of approval of these standards by the President of the United States and a letter with attachments by the Secretary of Commerce providing details and policy of their implementation. USGRDR

N70-37278# Joint Publications Research Service, Washington, D.C.

HYBRID MEMORY SYSTEMS

P. P. Kuvyrkov et al 14 Aug. 1970 8 p refs Transl. into ENGLISH from Prib. Sist. Upr. (Moscow), no. 6, 1970 p 8-10

(JPRS-51179) Avail: CFSTI

The design of optimal memory systems based on combinatorial coordinate systems is discussed and compared with the usual methods based on Cartesian coordinates in plane and space. The distinguishing feature of the combinatorial coordinate system is that each coordinate wire is designed as a complex wire, with all the geometric characteristics or spatial variables of n-dimensional arrays. Ferrite cores are used to store one-bit and multibit words. R.B.

N70-37318# Pennsylvania Univ., Philadelphia. Office of Engineering Research.

AN EVALUATION OF THE NCC TOPOLOGICAL SEARCH SYSTEM

David Lefkovitz and Morris Plotkin Sep. 1969 45 p

(Grant NSFC-547)

(PB-189473) Avail: CFSTI CSCL 05B

Experiments conducted in connection with evaluating the TSS (topological screen system) for structural chemical information retrieval are reported. The principal experiment may be defined: 35 real world questions encountered by FDA were submitted to the TSS and also the CAS retrieval system at FDA, and an evaluation of TSS, based upon a predetermined set of criteria was then made. The test file to which these questions were addressed was the Common Data Base prepared by FDA and NLM, which consisted of compounds. The 35 questions and the responses found by the TSS are presented. Author (USGRDR)

N70-37356# Institute of Nuclear Research, Krakow (Poland).

OPTICAL MODEL PROGRAMME WITH THE AUTOMATIC SEARCH ROUTINE "ALA-4"

Alicja Dudek 1969 45 p refs

(INP-689) Avail: AEC Depository Libraries

The ALA-4 program, in GIER-ALGOL 4 language for the computation of differential cross sections and polarizations of particles elastically scattered on complex nuclei is presented. The program permits an automatic search over the space of the nuclear optical model parameters, yielding optimum fit to experimental cross sections. Author (NSA)

N70-37360# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.

DOSPEC: A CEGB USERCODE PROGRAM FOR ANALYSING DATA FROM THE FOUR-DETECTOR DOSE SPECTROMETER

J. P. Longworth Mar. 1970 9 p refs

(RD/B/N-1611) Avail: AEC Depository Libraries

DOSPEC was written to calculate dose in four energy regions: thermal, 0.5 eV–30 keV, 30 keV–150 keV, and 150 keV–10 MeV, from counts obtained with four detectors. These included a 12EB40 BF3 counter, a Basson counter, an FN2/3 fast neutron counter and an Andersson–Braun Rem counter. The statistical errors and Albedo dosimeter spectrum factor are also calculated. Author (NSA)

N70-37378*# Maryland Univ., College Park. Computer Science Center.

MICROPROGRAMMING THE IOEX OF THE IBSYS

Ira L. Avrunin Jun. 1970 61 p

(Grant NGR-21-002-208)

(NASA-112784; TR-70-119) Avail: CFSTI CSCL 09B

The primary parts of IOEX are presented, as logical flow charts in algorithmic form. From these flow charts a hardware configuration is developed and sequence charts presented. From the sequence charts a control program is developed to present as a microprogram. It is shown that to develop a microprogram control sequence from a software system program is conceptually possible. Author

N70-37392# European Organization for Nuclear Research, Geneva (Switzerland).

COMPUTERS AND COMPUTATION IN EXPERIMENTAL HIGH ENERGY PHYSICS

G. R. Macleod Jul. 1969 55 p refs Presented at the Conf. on Computational Phys., Berkshire, Engl., 28-31 Jul. 1969

(CERN/DD/DH-69/8; CONF-690706-3) Avail: AEC Depository Libraries

A brief survey is given of the various uses of computers and the kind of computations made in high energy physics experiments. The successive stages of experiments, from the initial design to the final analysis of data, are described with examples chosen from recently completed experiments to illustrate the varied computing techniques used. Finally, some future trends to be expected are indicated, with particular reference to their dependence on developments in computer technology. Author (NSA)

N70-37397*# Maryland Univ., College Park. Computer Science Center.

A LOADER ALGORITHM FOR MICROPROGRAMMING

Oliver Ray Pardo May 1970 162 p refs

(Grant NGL-21-002-206)

(NASA-CR-112839; TR-70-113) Avail: CFSTI CSCL 09B

A loader algorithm for microprogramming is described for performing a unified hardware-software design. The loader is defined in its broader sense of a relocatable allocator and linkage editor. A loader algorithm is presented in detail in a series of flow charts. To facilitate understanding the flow charts are explained by an example. Suggestions for future research in implementing the algorithm in microprogram are made. Author

N70-37417*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.

A LIMITED SPEECH RECOGNITION SYSTEM 2 Final Report

Daniel G. Bobrow, Alice K. Hartley, and Dennis H. Klatt 1 Apr. 1969 36 p

(Contract NAS12-138)

(NASA-CR-112350; Rept-1819) Avail: CFSTI CSCL 09B

A limited speech recognition system, LISPER, was built and tested for use as a voice link with a computer. It was used as a trainable speech pattern recognition system and as a research tool for exploring the acoustic characteristics of speech as sampled by a computer. Objectives of this program include: 1. Development and evaluation of an improved expanded set of properties of both linguistic and nonlinguistic variety. 2. Investigate the relationship between linguistic and nonlinguistic features and evaluate their relative effectiveness. 3. Investigate speaker utility dependence of these properties for limited speaker dependence recognition. 4. To explore new techniques which utilize the information currently available from the spectral analyzer. Also included are results from previous work and utilization of the computer to be used by more than one speaker. E.H.W.

N70-37441# Weather Bureau, Silver Spring, Md. Engineering Div.

DIGITAL PRINTER/PLOTTER GRAPHICS TERMINAL

J. Michael St. Clair Mar. 1970 25 p

(PB-191187; ESSA-TM-WBTM-ENG-3) Avail: CFSTI

A high speed, hard copy, graphics output terminal for the computer complex at the National Meteorological Center is described. The terminal consists of an electrostatic digital printer/plotter, a small digital computer, and a communication modem for receiving and unpacking compressed data, and formatting and controlling the printer/plotter for presentation of graphical information. The operational terminal is currently being used in experiments for plotting maps of synoptic weather observations and prognoses (graphical forecasts) and for printing text information. Author (USGRDR)

N70-37459# General Electric Co., Schenectady, N.Y. Knolls Atomic Power Lab.

SIMPLE 1: AN ALGEBRAIC PROGRAMMING LANGUAGE FOR INTERACTIVE TIME-SHARED USE

Myles F. Barrett 9 Jan. 1970 20 p

(Contract W-31-109-eng-52)

(PB-191286; KAPL-M-7109; KAPL-M-MFB-1) Avail: CFSTI CSCL 09B

The SIMPLE language is intended to be used to perform straight-forward calculations without burdening the user with the intricacies of learning and using FORTRAN or BASIC. SIMPLE is designed with two purposes in mind. The language should be as close as possible to algebraic notation as it is commonly hand-written. Also, it should take advantage of the interactive feature of time-sharing as an aid to compilation as well as execution. This means that as soon as a line of input is typed by the user and the carriage return pressed, compilation of that line proceeds until an error is detected. At this point compilation stops and the user is told what and where the error is and allowed to retype the affected portion until it successfully compiles. Author (USGRDR)

N70-37484# California Univ., Livermore. Lawrence Radiation Lab.

MANAGEMENT OF COMPUTER AUTOMATION IN THE SCIENTIFIC LABORATORY

Jack W. Frazer 10 Dec. 1969 10 p Presented at Symp. Shared Program Controller, Albuquerque, N. Mex., 23-24 Sep. 1969 Submitted for publication Supported in part by AEC

(PB-189386; UCRL-72162) Avail: CFSTI CSCL 09B

The paper discusses the scientific laboratory manager's consideration and problems in choosing a data processing system for a laboratory. USGRDR

N70-37520*# Maryland Univ., College Park. Computer Science Center.

DESIGN AND SIMULATION OF AN ALGOL COMPUTER

Howard M. Bloom Jun. 1970 93 p refs

(Grant NGR-21-002-206)

(NASA-CR-112846; TR-70-118) Avail: CFSTI CSCL 09B

The functional design of a stored-program computer which can directly execute a program written in subset of the programming language, ALGOL 60 is described. For simplicity, a chosen subset does not contain arrays, procedures, switches, or for statements. The design is described by the Computer Design Language (CDL). (a) description of the subset of the ALGOL language using Backus Normal Form, (b) description of the basic elements needed to check the syntax of the program, (c) description of the design of the Algol computer, and (3) simulation of the design. These descriptions include a complete set of sequence charts and a complete description of the design in the Computer Design Language. A sample of output from a stimulation run is also shown. Author

N70-37589# Federal Communications Commission, Washington, D.C. Office of the Chief Engineer.

FREAVY: A FREQUENCY AVAILABILITY COMPUTER PROGRAM

John Williams and Phillip Tremper Mar. 1970 218 p refs Supersedes FCC-OCE-6901; PB-183614

(PB-189806; FCC-OCE-7002) Avail: CFSTI CSCL 17/2

FREAVY is an acronym for a computer program devised to provide ready access to basic information on FREquency

AVailability. The input data base consists of information derived from current FCC rules and regulations and includes frequencies allocated to the land mobile radio services, the specific classes of stations permitted, and special footnote limitations on use. While the initial effort was limited to the land mobile radio services and frequencies, the computer program is equally applicable to all radio services once appropriate data are extracted from the rules. The document is comprised of a discussion of the program and an attached computer list, Available Frequency File - Land Mobile Radio Service, which is the principal output of the program. Author (USGRDR)

N70-37595# Pennsylvania Univ., Philadelphia. Moore School of Electrical Engineering.
A DATA DESCRIPTION FACILITY
Diane Pirog Smith Apr. 1970 34 p refs
(Contract N00014-67-A-0216-0007)
(AD-703244; Rept-70-23) Avail: CFSTI CSCL 09B

Problems which have arisen in the management of data are examined for a common root. The examination suggests the need for better data description facilities. On this basis, an attempt is made to generalize the functions of data description, and a definition of a data description language is formulated. Current work on all aspects of these problems is surveyed and criticized on the basis of how well defined functions are fulfilled. Those problems on which no start has been made or for which only inadequate solutions have been proposed are summarized and a more comprehensive, generalized approach is proposed. Finally, the specification is given of a Data Description Language and its processor, which are being designed to meet the demands of the approach proposed and the problems discussed. Author (TAB)

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N70-36202# Harry Diamond Labs., Washington, D.C.
THIN-FILM TWIN-T OSCILLATOR
Lester A. Kitchman and William E. Isler Oct. 1969 26 p refs
(AD-700977; HDL-TM-69-30) Avail: CFSTI CSCL 9/5

Using HDL-developed deposition techniques, six film twin-T filters were fabricated consisting of alloy film resistors and silicon oxide capacitors. The filters oscillated in the range 1000 to 4400 Hz and displayed temperature coefficients less than 100 ppm/(degree C). Fabrication techniques are discussed along with planned changes necessary to meet HDL requirements for small, temperature-stable oscillators. Author (TAB)

N70-36243# Naval Postgraduate School, Monterey, Calif.
SENSITIVITY ANALYSIS ON NONLINEAR CIRCUITS
Ronald Alvin Lee (M.S. Thesis) Oct. 1969 109 p refs
(AD-705103) Avail: CFSTI CSCL 9/5

The use of the digital computer for the simultaneous generation of circuit responses and their corresponding sensitivity to parameter changes is considered for circuits containing diodes and transistors. Modeling of the diodes and transistors is based upon the Ebers-Moll equations, with the addition of voltage-dependent capacitors to account for switching time. The resulting general iterative equations are then used to calculate the effects of radiation on a p-n junction. The waveforms and circuit recovery time are studied as a function of circuit parameters. The use of sensitivity functions for predicting waveform variations is considered. Author (TAB)

N70-36275# Navy Underwater Sound Lab., New London, Conn.
THE IMAGE THEORY QUASI-STATIC FIELDS OF ANTENNAS ABOVE THE EARTH'S SURFACE
Peter R. Bannister 29 Dec. 1969 55 p refs
(AD-705499; NUSL-1061) Avail: CFSTI CSCL 9/5

Expressions for the quasi-static range (the measurement distance is much less than a free-space wavelength) field components produced by dipole antennas located above the earths surface have been derived by employing image theory. Formulas for the field components produced by an elevated, finite-length, horizontal electric antenna are also derived. Image theory is employed because most of the resulting integrals encountered can not be evaluated analytically. The image theory and previously derived analytical (or, in some cases, numerical integration) results are in good agreement throughout the quasi-static range. Author (TAB)

N70-36299# International Business Machines Corp., Hopewell Junction, N.Y. East Fishkill Lab.
MATHEMATICAL SIMULATION OF THE EFFECTS OF IONIZING RADIATION ON SEMICONDUCTORS Final Report, 1 Apr 1967–31 Dec. 1969
David P. Kennedy 1 Feb. 1970 241 p refs
(Contract F19628-67-C-0116)
(AD-703734; AFCRL-70-0078) Avail: CFSTI CSCL 9/1

The report outlines the results of the following mathematical investigations completed under the present contract: The junction field-effect transistor; The high-low semiconductor junction; The diffused semiconductor resistor; Measurement of impurity atom distributions by the differential capacitance technique; Electrical properties of very narrow-base diffused bipolar transistors; and Impurity atom diffusion of arsenic into silicon. Two of the investigations (junction field-effect transistor, and diffused semiconductor resistor) were conducted in two spatial dimensions, which include the mixed boundary conditions encountered at the surface of a semiconductor device; the others are in one spatial dimension. Each of these investigations is directed toward the solution of well recognized problems in the field of semiconductor device physics. Author (TAB)

N70-36313# Naval Ammunition Depot, Crane, Ind.
MICRO NOTES: INFORMATION ON MICROELECTRONICS FOR NAVY EQUIPMENTS
1 Feb. 1970 107 p
(AD-702751; NAD-CR-MICRO-NOTES-29) Avail: CFSTI CSCL 9/5

Contents: Microelectronic UHF power assembly; Microcircuit ultra high speed prescalers; LSI correlator; Minutes of the meeting of the DOD/NASA Committee on Research and Development of Plastic Devices and Materials (WGR and D); A compilation of the papers presented at the Open Session of the November 1969 meeting of the DOD/NASA Working Group on Test Methods and Procedures for Plastic Semiconductors; and Plastic encapsulation project. TAB

N70-36430# Sumitomo Electric Industries, Ltd., Yokohama (Japan).
ALLOY, COMPOSITE AND ELECTROPLATED CONDUCTOR WIRES RECENTLY DEVELOPED FOR ELECTRONIC USES
H. Shimizu, Y. Matsuda, and M. Ishikawa 1969 24 p Presented at the 18th Intern. Wire and Cable Symp., Atlantic City, 3-5 Dec. 1969
(AD-698616) Avail: CFSTI CSCL 9/1

The paper discusses the development of the electrical conductor materials used recently in electronic equipment. TAB

N70-36437# Naval Postgraduate School, Monterey, Calif.
A MODIFIED SERRODYNE TECHNIQUE TO PRODUCE PHASE MODULATION HAVING EQUIVALENT

HIGH-MODULATION INDEX
Larry Edward Miles (M.S. Thesis) Oct. 1969 37 p refs
(AD-706057) Avail: CFSTI CSCL 9/1

If a sawtooth wave is used as the modulating signal for the accelerating voltage of a traveling-wave tube, the input radio-frequency signal is phase modulated to produce a frequency shift in the output signal. The use of a sine wave as the modulating signal results in the familiar sine-wave-phase-modulated carrier as the output; however, it is difficult to obtain a large phase-modulation index without objectionable amplitude modulation. Specifically, if the peak-to-peak voltage swing of the modulating wave produces a phase shift of more than 2 pi radians in the radio-frequency carrier, the amount of amplitude modulation becomes severe. To overcome this severe amplitude modulation and yet produce large phase deviations in the carrier signal, i.e., broadband phase modulation, it is possible to chop the modulating waveform just as a ramp is chopped into a sawtooth. This thesis presents a design for so modifying the modulating signal be it sine wave, sawtooth, exponential or complex, and shows the resultant output spectrum of a traveling-wave tube whose carrier has been modulated by a chopped sine wave. Author (TAB)

N70-36485# Atomic Energy of Canada, Ltd., Pinawa (Manitoba). Whiteshell Nuclear Research Establishment.
A COOLED DEMOUNTABLE SHIELDED HOLLOW CATHODE LAMP AND CATHODES FOR ATOMIC ABSORPTION SPECTROPHOTOMETRY
B. Montford and S. C. Cribbs Aug. 1969 16 p refs
(PB-188665; AECL-3292) Avail: CFSTI CSCL 14B

The design, construction and use of a demountable spectral radiation source lamp for atomic absorption spectrophotometry are described. The lamp's chief advantages are its versatility, ease of fabrication and low cost. The hollow cathodes are cooled, demountable and shielded. The preparation of cathodes, operating conditions and evaluation for copper, aluminum, zinc, tin, mercury, lead, ruthenium, molybdenum, and silicon are given. Preparation of tantalum, tungsten and iridium cathodes is also included. Author (USGRDR)

N70-36471# Rochester Univ., N.Y. Dept. of Electrical Engineering.
THE JOSEPHSON JUNCTION AS A 100 GHz OSCILLATOR-MIXER
Andrew Longacre, Jr. and Signey Shapiro Apr. 1970 26 p refs Presented at Symp. on Submillimeter Waves, Brooklyn, 31 Mar. – 2 Apr. 1970 Submitted for publication
(Contract N00014-67-A-0398-0003)
(AD-704906) Avail: CFSTI CSCL 9/5

The term Josephson effects refers to a number of unusual properties of current flow through a barrier or weak link between two superconductors. Such a structure--called a Josephson junction--gives rise to frequency conversion effects that suggest its use as an oscillator-mixer in the millimeter and submillimeter region. Such a device would offer high sensitivity, broad bandwidth, tunability, and, in certain modes of operation, the possibility of conversion gain. These frequency conversion effects were observed in the range of 100 GHz to 600 GHz and beyond. The junctions were driven by a 75 GHz or 25 GHz klystron while coupled either to a coaxial cavity resonant at 20 GHz or to a resonance at about 500 GHz associated with the junction structure. Lines in the junction voltage-current characteristic were observed which demonstrated that, at certain values of junction bias, power at the rf--or its harmonics--was converted to power at the resonance frequency. An explanation of the experiment is given together with the necessary background, which provides the basis for a discussion of such operational considerations as upper frequency limit, sensitivity, temperature of operation, and saturation behavior at high signal levels. Author (TAB)

N70-36486# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A TECHNIQUE FOR SYNTHESIZING SIGNALS AND THEIR MATCHED FILTERS
Buchanan Loesch, Edward M. Hofstetter, and John P. Perry 29 Dec. 1969 29 p refs
(Contract AF 19(628)-5167)
(AD-704574; TR-475; ESD-TR-69-414) Avail: CFSTI CSCL 9/5

A nonuniformly tapped delay line is the key component in a device that can be used both to generate an arbitrary waveform and to act as a matched filter for this same waveform. Formulas for calculating the tap delays and weights needed to generate a given waveform are derived. The effects of delay-line attenuation and a technique for compensating for these effects are discussed. An experimental system embodying these design techniques is described. This system generates and receives a linear FM waveform of 0.5-microsecond duration and either 200- or 400-MHz bandwidth. Construction details and the results of many tests run on the system are given. Author (TAB)

N70-36494* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PRINTED CABLE CONNECTOR Patent
Hans G. Martineck, inventor (to NASA) Issued 22 Sep. 1964 (Filed 29 Aug. 1961) 6 p Cl. 339-176
(NASA-Case-XMF-00369; US-Patent-3,149,897; US-Patent-Appl-SN-134782) Avail: US Patent Office CSCL 09A

A device for electrically connecting printed cable to printed cable or to printed board is described. The connector housing has an elongated rectangular opening and has curved spring contact elements with hooked ends and internal interfitting with the housing configuration, with a view to providing resistance to deformation or displacement upon plug insertion. It is also provided with plug retaining means to prevent accidental displacement under dynamic load conditions and plug positioning means as a preventative against improper insertion of the plug and consequent short circuits. The electrical double ended socket developed is discussed. P.A.B.

N70-36793# Joint Publications Research Service, Washington, D.C.
TRANSISTOR RADIO RESEARCH IN USSR
17 Jul. 1970 34 p refs Transl. into ENGLISH from Izv. Vuzov SSSR, Radioelektron, (Kiev), no. 7 and no. 8, 1969 p 660 – 671 and 887 – 895
(JPRS-50969) Avail: CFSTI

CONTENTS:

1. HIGH-SPEED TRANSISTOR-TRANSISTOR LOGIC ELEMENT WITH COMPLEX INVERTERS V. P. Aleksandrov et al p 1 – 18 refs (See N70-36794 20-09)

2. DESIGNING A DYNAMIC INVERTER WITH MOS TRANSISTORS S. G. Basiladze et al p 19 – 32 refs (See N70-36795 20-09)

N70-36794# Joint Publications Research Service, Washington, D.C.
HIGH-SPEED TRANSISTOR-TRANSISTOR LOGIC ELEMENTS WITH COMPLEX INVERTERS
V. P. Aleksandrov et al *In its* Transistor Radio Res. in USSR 17 Jul. 1970 p 1 – 18 refs (See N70-36793 20-09)
Avail: CFSTI

An analysis is made of the action of high speed transistor-transistor logic elements (TTL) with complex inverters. Analytical expressions are given for calculating the static and transient performance of the elements, or for determining the requirements to be placed on element components if the parameters of the element are known. These expressions make it possible to find the connection between capacity and high speed action, and

also the optimal balance between these two factors for any particular case. Recommendations are made for the choice of transistor parameters and resistor ratings. It is shown that the TTL-5 element, proposed exhibits the best performance. A modification of this element is described which has a higher degree of noiseproofness. Author

N70-36795# Joint Publications Research Service, Washington, D.C.
DESIGNING A DYNAMIC INVERTER WITH MOS TRANSISTORS
S. G. Basiladze et al *In its* Transistor Radio Res. in USSR 17 Jul. 1970 p 19-32 refs (See N70-36793 20-09)
Avail: CFSTI

The design of a dynamic logical inverter with use of MOS field transistors with insulated gate is given, along with recommendations for choice of parameters. Author

N70-36831*# Bell Telephone Labs., Inc., Murray Hill, N.J.
PARTICLE DETECTION EXPERIMENT FOR APPLICATIONS TECHNOLOGY SATELLITE-1 (ATS-1), APPENDIX 2
W. M. Augustyniak, W. L. Brown, I. Hayashi, H. E. Kern, R. W. Kerr et al *In its* VLF Expt. Equipment for Appl. Technol. Satellite-2 (ATS-2) 1 Aug. 1969 270 p refs Prepared for Western Electric Co., Inc., N.Y.
Avail: CFSTI CSCL 09E

The ATS-1 particle experiments instrumentation is documented in detail, including the experimental scheme, the detector system, the electronic system, the experiment package design, components, reliability analysis, construction, ground support equipment, environmental testing, and the experiment carrying case. Block diagrams and schematic drawings are included. P.A.B.

N70-36859*# Westinghouse Electric Corp., Youngwood, Pa. Semiconductor Div.
DESIGN AND DEVELOPMENT OF A HIGH POWER, LOW SATURATION VOLTAGE, MULTI-CHIP SILICON SWITCHING TRANSISTOR Final Progress Report, Period Ending 19 Feb. 1970
Donald F. Stoneburner and Herbert E. Ferree 19 Feb. 1970 72 p Prepared for JPL
(Contracts NAS7-100; JPL-952309)
(NASA-CR-112870) Avail: CFSTI CSCL 09A

A total of 35 unusually low saturation voltage silicon power transistors were made. In addition to development work in silicon processing, considerable mechanical redesign was also done to eliminate an instability in saturation voltage. This was caused by the cracking of a silver plated contact within the hermetic seal of the devices themselves. The plating was eliminated and the units are now completely stable. Test data are discussed as well as factors leading to the final design and assembly of the units provided. Author

N70-36883*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Telecommunications Div.
SPACECRAFT RADIO
In its Space Programs Sum. No. 37-62, Vol. 3 30 Apr. 1970 p 90-92 ref (See N70-36876 20-34)
Copyright. Avail: CFSTI CSCL 09A

The advanced development of a multiple-cathode electron gun for long term operation of transmitters on outer-planet spacecraft is described. The device is a rotating disk with multiple cathode/filament assemblies rotated by a thermostatic motor, and indexed and locked by a thermostatically actuated arm. The first mechanical model had the cathodes radially disposed, but the second model had them axially disposed to provide better position control. The required number of thermostatic motors in the second model was reduced to one and its required heater power was reduced to 25 W. It is felt that vacuum and cycle testing demonstrated the feasibility of the multiple-cathode disk. N.E.N.

N70-37091*# Battelle Memorial Inst., Columbus, Ohio.
FEASIBILITY INVESTIGATION OF INSULATED-GATE FIELD-EFFECT TRANSISTORS FABRICATED BY TECHNIQUES COMPATIBLE WITH THICK-FILM TECHNOLOGY
R. D. Baxter 29 May 1970 42 p refs
(Contract NAS1-9220)
(NASA-CR-66976) Avail: CFSTI CSCL 09A

Techniques were investigated for depositing semiconducting layers at temperatures below those commonly used in the firing of thick film pastes, which would thereby reduce the effects of contamination of the semiconductor by diffusion of migrant impurities from adjacent thick film layers or components. The semiconductors employed were PbS and CdS. It was concluded that wet chemically deposited PbS and screen-printed $BaTiO_3$ are not promising candidate materials for thick film, insulated gate, field effect transistor applications. Continued investigation of low temperature processes for deposition of CdS and SiO_2, however, is recommended. Author

N70-37157# Oak Ridge National Lab., Tenn.
MAGNETIC FLUX FLOW AND SUPERCONDUCTOR STABILIZATION Final Report, 1 Oct. - 31 Dec. 1969
W. F. Gauster, S. Ihara, and M. J. Lubell May 1970 58 p refs Sponsored by AEC
(ORNL-TM-2980) Avail: CFSTI

A new graphical method for determining the current-voltage characteristics of superconducting wires in the flux flow state is presented. It can be applied to bare and stabilized wires. The cases of "thin" and "thick" filaments are considered. It is shown that realistic cryostatic stability criteria can be obtained only from the shape of the complete current-voltage characteristic and not simply from the slope of the tangent at the starting point of the flux flow characteristic. Furthermore, paradoxical results can be avoided if the dependence of the superconducting current on the electric field strength is taken into account. A review of the entire work performed from April 1, 1967 to December 31, 1969 is presented with detailed references to the various individual progress reports. An Appendix deals with recent research activities with Nb-Ti compound conductors with twisted filaments. Author (NSA)

N70-37184# Royal Aircraft Establishment, Farnborough (England).
SYNTHESIS OF ACTIVE PULSE FILTERS
G. F. Kimball Jan. 1970 21 p refs
(RAE-TR-70014) Copyright. Avail: CFSTI

A class of pulse forming networks described by Jess and Schussler was investigated with a view to providing practical low pass filter values. A set of practical values for each filter was computed so that an active filter might be made with a minimum of calculation. The class of filter designed is compared with the equivalent 'passive' version of the Jess and Schussler filter, and also with the well-known sine-squared filter. The latter has both a wider bandwidth and a longer rise time than the filters described in this report. Author (ESRO)

N70-37209# Joint Publications Research Service, Washington, D.C.
ULTRASHORT-WAVE ANTENNAS
A. I. Kolesnikov 14 Aug. 1970 51 p Transl. into ENGLISH from The book 'Spravochnik Ultrakorotkovolnovika' Moscow, DOSAAF Press, 1966 p 166-213
(JPRS-51174) Avail: CFSTI

The directional properties of a half wave dipole are discussed, along with the effect of the dipole dimensions, input impedance,

and feeding methods. Methods of balancing when using coaxial cables to feed antennas and high frequency transmission line properties are described. Other topics reviewed include estimation of the matching and magnitude of losses; directional antennas and the coefficient of directional effect; wave duct antenna characteristics and structural elements; short wave duct antenna calculational graphs and practical designs; long wave duct antennas complex directional systems for simultaneous operation of several directional antennas; corner reflector antennas; parabolic antennas; tuning of ultrashort wave, multielement wave duct, short wave duct, and long wave duct antennas; and monitoring the matching of the antennas. P.A.B.

N70-37268# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
FFTF PROCESS DATA DISPLAY PROTOTYPE
B. E. Dozer Apr. 1970 44 p refs
(Contract AT(45-1)-1830)
(BNWL-1330) Avail: CFSTI

Interfacing of a four-color cathode ray tube display to a digital computer is described. Interface diagrams and a description of operation are provided. It is concluded that with appropriate display routines available such a display system is a valuable control room device. Author (NSA)

N70-37322# Oak Ridge National Lab., Tenn.
CHARACTERISTICS OF A FUNNEL TYPE ELECTRON CHANNEL MULTIPLIER WITH A GRID ENTRANCE WINDOW
J. A. Ray and C. F. Barnett 8 Dec. 1969 22 p refs Submitted for publication
(PB-189038; ORNL-TM-2818) Avail: CFSTI CSCL 18 D

The response uniformity across the entrance window of a 1 cm diam funnel electron channel multiplier was increased by installing a high transparency grid in front of the multiplier and operating at the same potential. The funnel surface was scanned by a 1/8 diam 1-20 keV hydrogen atom beam. With either a negative potential applied to the front edge or positive potential to the collector, the response as indicated by the counting rate, was flat over the center 8-9 mm multiplier aperture. Measurements of the multiplier gain indicated maximum gain near the outer edge and minimum gain in the channel region. Author (USGRDR)

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N70-36916*# Connecticut Univ., Storrs. School of Engineering.
APPLICATION OF IMPERFECT, REDUCED-STATE RELAY CONTROL TO MODEL-REFERENCE SYSTEMS
T. M. Taylor Washington NASA Aug. 1970 75 p refs
(Grant NGL-07-002-002)
(NASA-CR-1645) Avail: CFSTI CSCL 09D

A design is proposed for model-reference controllers. In contrast to others, it leads to a controlled system in which the effects of several forms of imperfection may be evaluated. Such forms include relay dead-zone and hysteresis, saturation, additive noise in the switching function or filtered noise, error caused by neglecting transducer dynamics, and error caused by using filtered forms of measured states. The development leads to an estimate of the state bound that could result from the imperfections acting individually or together. Simulation results are obtained for an aircraft roll-control loop. Author

N70-36958*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
RELIABILITY TECHNIQUES FOR FLIGHT SYSTEMS
Paul Heffner Apr. 1970 57 p refs
(NASA-TM-X-65309; X-560-70-323) Avail: CFSTI CSCL 09C

When high reliability is required for a spacecraft electronic system, it is desirable to have a good perspective of various approaches to redundancy during both conceptual and design phases. Three fundamental techniques of applying redundancy are discussed. The discussion for each technique leads to the development of resultant curves that show the improvement given by that technique over one that uses only a simplex system. Each of these curves is plotted against the number of additional circuits required to implement the redundancy. Finally, the three techniques are compared to each other by reviewing their mission-lifetime improvements, with consideration given to the implementation penalty of additional circuits. For the various techniques, certain general conditions had to be made and maintained throughout the discussions to allow for reasonable comparisons. The conditions used for these comparisons are included. Some application work involving improving the reliability of an existing system is given. The system is the On-Board Processor, a spacecraft computer for the Orbiting Astronomical Observatory. Author

N70-36972# Weapons Research Establishment, Salisbury (Australia).
RECURSIVE DIGITAL FILTERING WITH ZERO PHASE SHIFT
J. L. Roughan Mar. 1969 18 p refs
(WRE-TN-TSD-36) Avail: CFSTI

A method is described which allows numerical smoothing of data to be carried out recursively without inducing any phase shift. The phase shift is removed by averaging the outputs from recursive digital filters operating in opposite directions over the data. A computer program, which embodies a functional minimization algorithm, has been constructed for the filter synthesis. The synthesized filter is in the form of several low order filters to be implemented in tandem. This enables easy characterization of stability and tends to reduce the effects of computer round-off during filtering. Author

N70-36974*# Arizona Univ., Tucson. Dept. of Electrical Engineering.
LUMPED ELEMENT MODELING OF TWO-DIMENSIONAL DISTRIBUTED RC NETWORKS
D. E. Robinson and L. P. Huelsman Jan. 1970 27 p refs
(Grant NGL-03-002-136)
(NASA-CR-112829) Avail: CFSTI CSCL 09C

The use of lumped network elements to model a uniform two-dimensional distributed RC network is described. Such modeling makes it possible to select arbitrary terminal topologies on the resistive surfaces of two- and three-layered distributed networks. An implementation of the theory on the digital computer is presented, and the results obtained from analyzing several terminal topologies are given. One of these topologies illustrates the feasibility of using a single distributed RC network as a null device. Author

N70-37311# Bureau of Radiological Health, Rockville, Md. Div. of Electronic Products.
X-RAY EMISSION FROM COLD CATHODE GAS DISCHARGE TUBES USED FOR EDUCATIONAL PURPOSES
William S. Properzio, Ray C. Woodcock, and Sidney D. Heidersdorf Feb. 1970 46 p refs
(PB-189890; DEP-70-1) Avail: CFSTI CSCL 13L

A study is presented to identify cold-cathode gas discharge devices used for educational purposes that may emit X-radiation. In addition to cold-cathode X-ray tubes, a number of other gas discharge devices were found to emit X-rays. A summary of

laboratory measurements of the X-ray outputs from these tubes is presented. Recommendations are given regarding use of the tubes, based on these experimental data. Specific comments are directed to the science teacher utilizing the equipment, the distributor, and State or local radiological health agencies. Author (USGRDR)

N70-37425# Bureau of Radiological Health, Rockville, Md.
ADVANCES IN THE USE OF MICROWAVE POWER
W. A. Geoffrey Voss 1970 32 p refs *Its* Seminar Paper No. 008
(PB-191800) Avail: CFSTI CSCL 13A

The industrial and domestic use of microwave power, as a source of heat, is increasing. The physical advantages of microwave heating, and the methods used to apply this form of energy in the processing industries are discussed. The need for a closer cooperation between the electronic systems designer and the environmental scientist is emphasized. Both have the responsibility of studying the biological effects of high frequency energy and ensuring the safety of operating personnel. The design of wavetraps and door seals will be considered in detail. Methods of both preventing and measuring leakage power in the microwave frequency spectrum is discussed. Author (USGRDR)

N70-37572# Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.
ADAPTIVE AND SELF-OPTIMIZING CONTROL Final Report, 1 Feb. 1961 – 31 May 1970
Raymond E. Goodson 15 Jun. 1970 20 p
(Contract Nonr-1100(20))
(AD-707088) Avail: CFSTI CSCL 12/1

The final report summarizes the research accomplished on the contract by reference listing with appropriate abstracts the publications, books, technical reports, and theses completed under contract support. Author (TAB)

N70-37573# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AUTOMATIC CONTROL SYSTEMS WITH VARIABLE STRUCTURE
S. V. Emelyanov 26 Mar. 1970 330 p refs Transl. into ENGLISH of the book 'Sistemy Avtomaticheskogo Upravleniya's Peremennoi Strukturoy' Moscow, Izd-Vo Nauka, 1967 p 1–335
(AD-706780; FTD-MT-24-381-69) Avail: CFSTI CSCL 12/1

The book examines principles of construction of one class of nonlinear automatic control systems - systems with variable structure. Basic attention is allotted to different problems of control of linear objects with constant and variable parameters both for free and for forced motions. It is shown that the principle of changeability of structure permits ensuring high-quality control of free motion of an object, and in the case of change of parameters in a wide range permits constructing a system insensitive to these changes. Methods of synthesis of control for objects working under conditions of continuously acting external perturbing forces are given. It is shown that for a broad class of disturbances it is possible to ensure independence of quality indicators of the control process by using executing devices with variable structure. A very important peculiarity of the examined class of systems from the practical point of view is that for realization of offered laws of control required is information neither about the value of variable parameters of the object nor on disturbances applied to it. The offered methods of control of objects with one adjustable value are generalized in case of multiconnected objects with several adjustable coordinates. Author (TAB)

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N70-36292# Naval Postgraduate School, Monterey, Calif.
THE COMBINATION OF A GLOBAL ROUTING ALGORITHM AND A PATH-FINDING ALGORITHM FOR AN UNMANNED ROVING VEHICLE
Marvin Hubert Floom, Jr. (M.S. Thesis) Oct. 1969 102 p refs
(AD-705491) Avail: CFSTI CSCL 12/2

In future space missions it is planned that an unmanned robot will be sent to explore the other planets surface. Control of the vehicle from earth is unrealistic because of the long delay time in the transmission of data. From a gross knowledge of the terrain a global routing algorithm can be used to find an optimal path from one point to another. A survey was undertaken to find an algorithm best suited for this use. Dynamic programming was selected and in combination with Lims path-finding algorithm provec to be successful in simulated vehicle explorations over terrain represented by Gaussian density functions. Author (TAB)

N70-36423# Naval Air Development Center, Johnsville, Pa. Aero-Electronic Technology Dept.
HIGH CURRENT (SHORT-CIRCUIT) FACILITIES FOR AIRCRAFT CONTROL AND PROTECTIVE DEVICES Progress Report
P. F. Ardizzi 17 Jul. 1969 68 p
(AD-705504; NADC-AE-6883) Avail: CFSTI CSCL 14/2

The report describes the NAVAIRDEVCEN updated a-c and d-c high current (short-circuit) facilities for overload and rupture testing of aircraft control and protective devices; also outlined are the procedures and conditions covering the usage of the facilities by other governmental activities and industry. Author (TAB)

N70-36528* Arizona Univ., Tucson.
STOCHASTIC ALGORITHMS FOR SELF-ADAPTIVE FILTERING AND PREDICTION
Robert L. T. Hampton *In its* Res. in an Appl. of Mod. Autom. Control Theory to Nucl. Rocket Dyn. and Control Jan. 1970 51 p refs (See N70-36526 20-19)
Avail: CFSTI CSCL 09D

The problem of self-adaptive optimal estimation of a sampled stochastic signal observed in random noise is formulated and an engineering solution is developed. The learning criterion is developed, and the adaptive stochastic algorithms are derived. Experimental results obtained by applying the learning criterion and associated algorithms to specific systems are presented. Author

N70-36547# Dayton Univ. Research Inst., Ohio.
THE AIR FORCE MATERIALS LABORATORY TERMINAL BALLISTIC RESEARCH FACILITY
Robert S. Bertke Oct. 1969 33 p refs
(Contract F33615-68-C-1138)
(AD-704898; UDRI-TR-69-24; AFML-TR-69-215) Avail: CFSTI CSCL 19/4

The ballistic research facility described in this report was constructed by the University of Dayton Research Institute for the Air Force Materials Laboratory. The facility is capable of launching conventional small arms projectiles and simulated fragments with controlled velocities at targets of materials under investigation. Conventional projectiles up to and including 20-mm projectiles may

be launched at maximum service velocities. Simulated fragments with principal dimensions up to 1/2 inch may be launched at velocities from below 1,000 feet per second to above 6,000 feet per second. Peak velocities of near 10,000 feet per second may be achieved with small fragment simulators. The basic range instrumentation is designed to monitor the velocity of launched projectiles. Sandwich-type contact switches constructed of aluminum foil and mylar are used to trigger the velocity chronographs and x-ray equipment. Still cameras and a high speed framing or streak camera may be used to provide photographic coverage of the projectile in flight and the impact event. A mechanical device is used to apply or simulate external stresses to structural targets during impact and determine the residual strength after impact. Author (TAB)

N70-36674*# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Mobility and Environmental Div.
PERFORMANCE EVALUATION OF WHEELS FOR LUNAR VEHICLES Summary Report
D. R. Freitag, A. J. Green, and K.-J. Melzer May 1970 85 p refs Sponsored by NASA *Its* Misc. Paper M-70-4
(NASA-CR-112678; AD-705570) Avail: CFSTI CSCL 13F

One pneumatic wheel, four metal-elastic wheels, and two instrumented vehicles were laboratory tested in a fine sand to determine their relative performance and to establish a better understanding of the basic principles of the interaction of very lightly loaded wheels with a soil whose properties were varied to include the probable range of lunar soil properties. Programmed-slip tests were conducted with the single wheels and the vehicles, the latter being tested on both slopes and level surfaces. Data indicate that for loads less than about 220 N (50lb), the pull/slope-climbing ability was constant for a given soil condition. At greater loads, the rate of increase in performance decreased. The effect of cohesion on performance was negligible at loads less than about 220 N (50 lb), but the effect could be seen at higher loads. The power required, in whr/km, for operation of the wheels on level and sloping soil surfaces was determined. It was demonstrated that data from single-wheel tests can be used to predict the slope-climbing ability of a vehicle; such predictions tend to be slightly conservative. Results of tests with the vehicles indicate that the torque coefficient at a given slip was not significantly affected by variations in surface slope and soil strength. Author (TAB)

N70-36691*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CALIBRATION, SIMULATION, AND TESTING OF LARGE ORBITING STELLAR OBSERVATORIES
James L. Diggins *In its* Opt. Telescope Technol. 1970 p 113–132 refs (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 14B

Presented is the state-of-the-art in calibration and testing of large orbiting observatories designed to perform in the field of stellar astronomy. Considered are observatories of the OAO class, namely, 7 1/4 feet in diameter by 10 feet high and weighing from 4000 to 4600 pounds in the orbital configuration. The largest aperture telescope in the current OAO series is 38 inches in diameter. Discussed are techniques, equipment, and facilities for simulating, testing, and calibrating as final activities just prior to launch. G.G.

N70-36716*# Kitt Peak National Observatory, Tucson, Ariz.
SHOP SUPPORTS FOR THE 150-INCH KITT PEAK AND CERRO TOLOLO PRIMARY MIRRORS
Norman Cole *In* NASA, Washington Opt. Telescope Technol. 1970 p 307–309 ref (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 14B

The air-pad-support system, devised for the Kitt Peak and Cerro Tololo 150-inch mirrors, lends itself to use in the optical shop. The system permits polishing with a 9000-pound tool, and yet, without removal from the polishing machine, the mirror can be tested on the same support system that it will have in the telescope. Testing is carried out at the top of a 70-foot tower where a turret mirror can select any of several test devices. Author

N70-36751*# Aero Vac Corp., Troy, N.Y.
VACUUM SYSTEMS FOR SPACE SIMULATION
David H. Holkeboer *In* NASA, Washington Opt. Telescope Technol. 1970 p 699–702 (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 14B

Three major types of vacuum systems are described: the basic system, the cold-wall system, and the ultrahigh vacuum system. The vacuum level achieved is dependent on the gas load, pumping speed, and ultimate pressure of the pump subsystem. Pumping subsystems consist of roughing and high vacuum systems, which are principally ion pumps, diffusion pumps, cryopumps, and sublimation pumps. The major advantages and disadvantages of the various systems are discussed. Author

N70-36752*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPACE THERMAL-SIMULATION SYSTEM
Henry Maurer *In its* Opt. Telescope Technol. 1970 p 703–731 refs (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 14B

Space thermal simulation used in testing complete spacecraft systems are discussed and research areas significant in advancing technology for providing a capability to test large ultraviolet telescopes of the future are suggested. The state-of-the-art of the system test, space thermal simulator field, and some of the factors affecting the results obtained in thermal balance testing of spacecraft are reviewed. Author

N70-36756*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HARD RADIATION ENVIRONMENT SIMULATION
Fred W. Paul *In its* Opt. Telescope Technol. 1970 p 759–788 refs (See N70-36676 20-14)
Avail: CFSTI HC $10.00/MF $0.65 CSCL 14B

The methods used to simulate the hard radiation environment to which optical telescopes are exposed in local earth orbits are discussed. The components of hard radiation are galactic and solar cosmic radiation, solar X-rays and ultraviolet, the solar wind, trapped charged particles, and ionized layers of the upper atmosphere. The characteristics of a particular class of devices are studied and a decision is made about which part of the radiation environment is most likely to modify the performance of the system. Specific examples are given to illustrate some of the procedures used to test radiation effects on optical components. R.B.

N70-36758*# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Avionics Lab.
OPTICAL RESEARCH FACILITIES
William R. Pershing *In* NASA, Washington Opt. Telescope Technol. 1970 p 781–783 (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 14B

An optical laboratory equipped for precision optical measurements in the design, fabrication, and evaluation of components and systems is described. The facility is centered around a large optical collimator of 100 inch diameter and includes the necessary instrumentation and equipment for conducting extensive research and analyses of large diameter optics and optical

systems. Instrumentation for optical surface evaluation, laser light sources, and a darkroom for processing films and plates are also located in the facility. R.B.

N70-36850# Weapons Research Establishment, Salisbury (Australia).
OVERTOPPING TESTS ON THE Mk 3 LIQUID OXYGEN SYSTEM AT AREA 6 WOOMERA; USING LOW STORAGE TANK PRESSURE
T. W. Miller Jul. 1969 26 p refs
(WRE-TN-DWD-26) Avail: CFSTI

Results are presented of tests carried out on the Mark 3 liquid oxygen system at area 6 Woomera during the period 9th to 11th April 1969. The tests were to investigate the possibility of using reduced storage tank pressure when pumping liquid oxygen to the Europa 1 First Stage. Author

N70-36858 European Organization for Nuclear Research, Geneva (Switzerland).
POSITIONING OF THE CERN INTERSECTING STORAGE RINGS: THE GEODETIC APPROACH
J. Gervaise 30 Jun. 1970 31 p refs Presented at the Journee d'Inform. sur la Topometrie de Haute Precision, Lyon, 13 Feb. 1970
(CERN-70-18) Copyright. Avail: Issuing Activity

The intersecting storage rings (ISR) consist of two concentric rings of magnets in which protons travel in opposite directions. The magnets are housed in a circular underground tunnel and are interlaced as to intersect at eight points where the beams can be made to collide. The problem of positioning the ISR components is approached geodetically; ISR geometry, laying out, and linking up with the 28 GeV accelerator are discussed. ISR metrology, based solely on distance measurements, is discussed, and a comparative analysis of the geometry of the 28 GeV PS is made with that of the ISR. The method to be used for aligning the 800 MeV booster synchrotron is described. An approach is made to the metrology to use for the future 300 GeV synchrotron. P.A.B.

N70-36893*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Environmental Sciences Div.
SPACE SIMULATORS AND FACILITY ENGINEERING
In its Space Programs Sum. No. 37-62, Vol. 3 30 Apr. 1970 p 223-227 (See N70-36876 20-34)
Copyright. Avail: CFSTI CSCL 14B

The simulation of cosmic radiation, solar flares, solar winds, and Jovian radiation belts is studied for accelerated testing of outer planet missions. The operating conditions of accelerated testing, equivalent to a 10-year mission are tabulated. F.O.S.

N70-36909# Hovey-Sores (Ottawa).
AN ANALYSIS OF AIRPORT SNOW REMOVAL AND ICE CONTROL Interim Report
D. J. Tighe, L. A. Garland, and J. C. Cairo Apr. 1970 118 p refs
(Contract FA-68-WAI-149)
(FAA-RD-70-39) Avail: CFSTI

An approach is described using modelling techniques by which airport snow removal and ice control systems may be evaluated on a cost effectiveness basis, taking into account (1) airport type, size, and structure; (2) incidence of snow and/or icing conditions; and (3) volume and type of air traffic. Technical characteristics of the equipment and systems are also discussed. Conclusions and recommendations are enumerated for factors influencing system design, current snow removal and ice control practices, and future research in airport snow removal and ice control. Author

N70-36913* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ELECTRIC ARC DRIVEN WIND TUNNEL Patent
Oscar C. Holderer, inventor (to NASA) Issued 11 May 1965 (Filed 12 Dec. 1961) 6 p Cl. 73-147
(NASA-Case-XMF-00411; US-Patent-3,182,496;
US-Patent-Appl-SN-158914) Avail: US Patent Office CSCL 14B

An arc triggering system is described which is intended to simplify previous systems and to reduce the contamination of the gas within the pressure chamber of an electric arc driven impulse tunnel. An electrical potential is placed between one primary electrode and the housing wall of a pressure chamber, and an actuating means is provided to obtain at the desired instant, without the use of bulky complex switching gear, a conductive path of ions between the primary electrode and the housing wall to initiate a hot spark discharge. Only one primary insulated electrode is required because of the use of the pressure vessel wall as the second primary electrode. Examples of different forms of the actuating means are given, with and without the use of a tease wire. P.A.B.

N70-36985# Technion - Israel Inst. of Tech., Haifa. Aeronautical Research Center.
THE IIT 40cm x 50cm INTERMITTENT, SINGLE JACK, FLEXIBLE NOZZLE SUPERSONIC WIND TUNNEL-CALIBRATION AT MACH NUMBERS 1.5 TO 3.0
I. Etsion, J. Rom, and M. Salomom Apr. 1970 22 p refs Presented at 33d Semiann. Meeting of the Supersonic Tunnel Assoc., El-Segundo, Calif., 7-8 May 1970
(TAE-110) Avail: CFSTI

A test program was conducted to calibrate the test region of the 40cm × 50cm single jack, flexible nozzle supersonic wind tunnel. A general description of the wind tunnel as well as results of the calibration at nominal Mach numbers of 1.5, 2.0, 2.5 and 3.0 are presented. The maximum Mach number variation was + or − 0.01 along the centerline of the sidewall and also + or − 0.01 in the test cross section area for all these Mach numbers. Author

N70-37016# Roma Univ. (Italy). Scuola di Ingegneria Aerospaziale.
DESIGN CRITERIA AND CHARACTERISTICS OF THE BLOWDOWN WIND TUNNELS OF THE CENTRO RICERCHE AEROSPAZIALI [CRITERI DI PROGETTO E CARATTERISTICHE DEGLI IMPIANTI AERODINAMICI INTERMITTENTI DEL CENTRO RICERCHE AEROSPAZIALI]
Ugo Ponzi Jun. 1969 46 p refs In ITALIAN; ENGLISH summary *Its* ATTI del Centro Ric. Aerospaziali No. 22
Avail: CFSTI

After general consideration of blowdown wind tunnel operation, the basic criteria and methods for their design and for the calculation of their characteristics are reviewed. The three main elements of these facilities, the air storage, vacuum, and thermal capacity heating systems, are discussed and the blowdown wind tunnels of the Centro Ricerche Aerospaziali (CRA) are described. Author (ESRO)

N70-37021# National Aviation Facilities Experimental Center, Atlantic City, N.J.
SIMULATION OF A CONTINUOUS RUNWAY CENTERLINE MARKING Interim Report
Guy S. Brown and Richard L. Sulzer Aug. 1970 27 p
(FAA-RD-70-40; FAA-NA-70-21) Avail: CFSTI

A simulation study was conducted to compare a continuous runway paint marking with the U.S. standard broken centerline stripe under low-visibility conditions. Overall results showed no strong preference for the guidance value of the continuous centerline. Despite this, the most experienced pilots reported advantages in the continuous mark in that it could be seen farther in reduced

visibility and gave slightly better guidance; however, they indicated only a moderate strength of preference. Highlighting one advantage of an interrupted centerline marking, pilots stated the need for speed information. A strong chance was noted that the location of the markings could be confused if the present standard system were revised by exchanging the locations of interrupted and continuous markings. Pilots also reported that VFR as well as instrument runways need to have a common marking. The preferences and comments of the most experienced subject pilots suggest that the present centerline could be improved for low-visibility operations by reducing the length of the gap, without giving up the benefits of speed information, while retaining the broken centerline concept. Author

N70-37035# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
CAPABILITY OF A TYPICAL MATERIAL BALANCE ACCOUNTING SYSTEM FOR A CHEMICAL PROCESSING PLANT
R. A. Schneider and D. P. Granquist May 1970 35 p refs
(Contract AT(45-1)-1830)
(BNWL-1384) Avail: CFSTI

The development of two basic models, a capability model and a performance model, for a chemical processing facility is discussed. The capability model represents the best performance (the smallest error) that the measurement system is theoretically capable of achieving in an operating environment. The performance model represents that expected in practice from a high quality measurement system. A Purex-type flowsheet was assumed for a plant operating on a clean-plant-to-clean-plant basis. It was also assumed that a campaign consists of 40 tons of irradiated low-enriched uranium containing 10,000 g/ton of plutonium. NSA

N70-37041# California Univ., Berkeley. Lawrence Radiation Lab.
ENGINEERING STUDY OF RADIOLOGICAL FIRE PREVENTION AT LAWRENCE RADIATION LABORATORY, BERKELEY, CALIFORNIA
Jensen Young Jan. 1970 34 p refs Presented at the Am. Ind. Hyg. Assoc. Conf., Detroit Sponsored by AEC
(UCRL-19465) Avail: CFSTI

Some of the engineering steps taken at the Lawrence Radiation Laboratory, Berkeley, California, to reduce the hazards of fire in radioisotope areas are discussed and evaluated. These include the selection of fire-retardant materials for enclosures to meet the variable and unpredictable demands of researchers, fire tests on enclosure components, modification and testing of a fire extinguisher for glove boxes, evaluation of radioisotope storage areas, and a critical look at mechanical ventilation in a radiological fire. NSA

N70-37122# California Univ., Livermore. Lawrence Radiation Lab.
A PULSED DIVERTER AND GUIDE FIELD FOR THE SUPERCONDUCTING LEVITRON
E. J. Lauer 13 Feb. 1970 9 p Sponsored by AEC
(UCRL-50807) Avail: CFSTI

The design of a pulsed diverter and guide field for the Superconducting Levitron is optimized so that a maximum area at the remote end of the guide field coil is bounded by magnetic flux lines which lie on useful flux surfaces in the Levitron. The guide field is compensated for the fringe field of the Levitron. Flux lines are followed using a numerical calculation. For torus currents corresponding to 300 kA in the floating ring, a guide solenoid current producing about 15 kG results in the above area being about 2 or 3 cm by 4 or 5 cm. Author (NSA)

N70-37186*# General Electric Co., Cincinnati, Ohio.
ADVANCED REFRACTORY ALLOY CORROSION LOOP PROGRAM Quarterly Progress Report, 15 Jan. 1970–15 Apr. 1970
R. W. Harrison and J. P. Smith 11 May 1970 37 p refs
(Contract NAS3-6474)
(NASA-CR-72739; GESP-491; QPR-20) Avail: CFSTI CSCL 11F

The T-111 Rankine system corrosion test loop successfully completed the planned 10,000 hours of continuous operation. The alkali metal was drained from the loop and preparation for posttest evaluation was initiated. Visual examination of the loop showed it to be in excellent condition. The 1900 F lithium loop achieved test conditions on January 31, 1970 and has accumulated 1725 test hours of operation. Two ASTAR 811C potassium reflux capsules successfully completed 5000 hours of testing. One of the capsules was opened and prepared for posttest evaluation. Author

N70-37337# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
AIRCRAFT NOISE AND AIRPORT NEIGHBORS: A STUDY OF LOGAN INTERNATIONAL AIRPORT
Peter A. Franken and David Standley Mar. 1970 178 p refs
(Contract DOT-OS-A9-009)
(PB-190118; DOT/HUD-IANAP-70-1) Avail: CFSTI CSCL 01E

The report describes a study of means for providing relief from aircraft noise annoyance to residents of the vicinity of Logan International Airport, Boston, Massachusetts. The noise exposure situations in 1967 and 1975 are described in terms of such measures as land area, populations, schools, and hospitals affected. Operational noise abatement procedures considered include flight track changes, preferential runway systems, runway threshold shifts, aircraft type restrictions, power cutbacks, and schedule restrictions. Nonoperational abatement procedures considered include land use management and redevelopment, and acoustic insulation. The report also describes the utilization of abatement procedures at other major airports, and presents a generalization of the approaches developed in a form suitable for use by other airport authorities. Author (USGRDR)

N70-37424*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE EARTH-MOON TEST RANGE
Robert C. Wigand Jun. 1970 24 p Proposed for presentation at 1st Western Space Congr., Santa Maria, Calif., 27–29 Oct. 1970
(NASA-TM-X-65316; X-834-70-239) Avail: CFSTI CSCL 14B

Recent developments in technology, including the demonstrated capability to emplace and operate equipment packages on the lunar surface, have established the feasibility of an Earth-Moon Test Range. The Range will investigate the characteristics of the Earth's macroenvironment in cislunar space and will develop new techniques for the use of electromagnetic signals. Advantages of lunar distance in experimental control, perspective, and calibration, as well as the benefits of initiating a Range program are discussed. Author

N70-37528*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DEVELOPMENT AND TESTING OF THE LUNAR GRAVITY AND EARTH ORBITAL SIMULATOR (PARALLELOGRAM)
H. T. Blaise 12 Sep. 1969 19 p
(NASA-TM-X-53892; MSFC-IN-ME-68-13) Avail: CFSTI CSCL 14B

An account of work accomplished in the development and testing of the lunar gravity and earth orbital simulator or parallelogram (L/G and E/O) is given. The L/G and E/O was developed and tested from contract specifications. Included in the report are events and happenings during development, proof testing, irregularities of achieving balance of the L/G and E/O and the remedies used to correct the faults. Author

N70-37529*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AERODYNAMIC DESIGN AND CALIBRATION OF THE MSFC THERMAL-ACOUSTIC JET FACILITY: COLD FLOW DUCT
K. D. Johnston and W. C. Tidmore 12 Sep. 1969 51 p refs
(NASA-TM-X-53907; MSFC-IN-AERO-69-1) Avail: CFSTI CSCL 14B

The aerodynamic design of the cold flow duct is reviewed, and some of the data obtained in the calibration test of the facility are presented. The calibration test showed that good control of the settling chamber pressure could be maintained from 689,000 N/sq m to 17 million N/sq m, well within the + or — 1 percent design limits and that the facility was generally suitable for a variety of tests requiring a cold jet exhausting into the atmosphere. Author

N70-37586*# Computer Applications, Inc., Huntsville, Ala. Systems Engineering Div.
STUDY OF SATURN 1B FACILITIES AND EQUIPMENT FOR IMPROVED LAUNCH CONTROL OF AAP MISSIONS. VOLUME 1: EXECUTIVE SUMMARY, 1 DECEMBER 1968 – 1 FEBRUARY 1970
Feb. 1970 24 p
(Contract NAS10-6170)
(NASA-CR-113037) Avail: CFSTI CSCL 22D

This report documents a study of Saturn 1B launch control and its dependence on launch facilities, support equipment and associated procedures. Intended to provide planning criteria for Apollo Applications Program prelaunch mission support, the study focuses on the current capability of responding to AAP launch window constraints. Launch support availability is established on a quantitative basis, and equipment systems which contribute to launch delay are identified. Possible methods of improving launch control are designated. The results and analyses of this report are submitted. Author

N70-37587*# Computer Applications, Inc., Huntsville, Ala. Systems Engineering Div.
STUDY OF SATURN 1B FACILITIES AND EQUIPMENT FOR IMPROVED LAUNCH CONTROL OF AAP MISSIONS. VOLUME 2: FINAL STUDY REPORT, 1 DECEMBER 1968 – 1 FEBRUARY 1970
Feb. 1970 188 p refs
(Contract NAS10-6170)
(NASA-CR-112782) Avail: CFSTI CSCL 22D

The results of the launch support availability study and the associated analyses that were conducted are documented. The basis of the analytical approach and the development of necessary supporting data are presented together with the significant results of the countdown evaluation. Methods for improving launch control are recommended. Author

N70-37588*# Computer Applications, Inc., Huntsville, Ala. Systems Engineering Div.
STUDY OF SATURN 1B FACILITIES AND EQUIPMENT FOR IMPROVED LAUNCH CONTROL OF AAP MISSIONS. VOLUME 3: USER'S MANUAL, 1 DECEMBER 1968 – 1 FEBRUARY 1970
Feb. 1970 105 p
(Contract NAS10-6170)
(NASA-CR-113038) Avail: CFSTI CSCL 22D

The user's manual comprises all the information required to enable the analyst of the launch operation to understand and use the launch operation model to determine launch availability. It assumes that the analyst has previously acquired a good working knowledge of the launch operation, its procedures, mission rules, equipment requirements, and the schedule of activities and their interrelations. Section 2 of this manual details the launch operation model and its employment as an analytical device to give a mathematical representation of the launch sequence. A computer program was developed to perform the computational requirements imposed by the model. The use of this program is documented in section 3. The purpose, format and type of data required by the program are detailed in this section. It also specifies the several output features available to the user and how each is employed. Section 4 is a compilation of those items of interest to the programmer who requires more specific information concerning the inner workings of the computer program. Author

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N70-36217# Boeing Co., Renton, Wash. Commercial Airplane Div.
VELOCITY AND THERMAL PROFILES IN VALVES AND THEIR EFFECTS ON VALVE EROSION
S. K. Srinath 25 Feb. 1970 80 p refs
(AD-702173; D6-25525) Avail: CFSTI CSCL 13/11

Hydrodynamic and thermal flow solutions are obtained for leakage flows in hydraulic valves using a two-dimensional incompressible viscous flow converging towards a sink in a 90 deg channel. Examples of applications to aircraft fluids are given. Effects of peak temperatures in the thermal boundary layer on the valve erosion phenomena are discussed. Author (TAB)

N70-36256# Utah State Univ., Logan. Water Research Lab.
FINITE DIFFERENCE SOLUTIONS TO FREE JET AND CONFINED CAVITY FLOWS PAST DISKS WITH PRELIMINARY ANALYSES OF THE RESULTS, 1 DECEMBER 1968 – 30 OCTOBER 1969
Roland W. Jeppson Nov. 1969 93 p refs
(Contract N00014-67-A-0220-0002)
(AD-704490; PRWG-76-1) Avail: CFSTI CSCL 20/4

Finite difference methods are utilized in solving the nonlinear inverse boundary value problem for modeling the axisymmetric, inviscid cavity flows past disks. The Riabouchinsky model is utilized in the formulation of the problems. The results from a number of solutions for both the problem in which the disk is placed in a free surface jet and for the problem in which the disk is placed within a flow confined in a constant radius conduit are analyzed, and parameter commonly used to characterize such flows are correlated to indicate the influence of the confining boundary on this type of cavity flow. Author (TAB)

N70-36296# Virginia Univ., Charlottesville. Research Labs. for the Engineering Sciences.
INTERACTION OF GRID TURBULENCE WITH A UNIFORM MEANSHEAR Final Report, 1 May 1966 – 28 Feb. 1969
William G. Rose Mar. 1970 30 p refs
(Grant AF-AFOSR-1078-67)
(AD-703741; AEEP-3436-101-70U; AFOSR-70-0919TR) Avail: CFSTI CSCL 20/4

Experiments were performed to explore the effect of initial disturbance length-scale on turbulence developed in the presence of a uniform mean-shear. Flows with nearly the same mean-shear (8.6/sec) and initially different turbulent scales are generated in a windtunnel test-section by placing grids just downstream of a honeycomb of uniform cell-diameter (1/4 in) and nonuniform cell-length. Both round-rod grids of uniform square-mesh and

parallel-rod construction with roughly equal solidity (0.34) are used. Grid mesh-sizes range from 1/24 to 2 in. From the results it is concluded that for a given value of mean shear the imposed length scale fixes the energy level of the resulting turbulence, provided the scale is sufficiently large. When it is reduced below some minimum value the turbulence decays. Also, it is found that two-dimensional flow-generator geometries are more effective than are three-dimensional geometries in producing a roughly homogeneous turbulent field with a higher fluctuation level in a shorter distance.
Author (TAB)

N70-36321# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Mechanical Engineering.
DYNAMICS OF TWO PHASE FLOW
Frank W. Paul, Klaus J. Riedle, and S. William Gouse, Jr. Apr. 1970 90 p refs
(Contract N00014-67-A-0314-0003)
(AD-704501; TR-1) Avail: CFSTI CSCL 20/4

The report describes work on the dynamics of two-phase flows within a vertical-upflow channel. Both experimental studies, using Freon 11 as the working fluid, and analytical modeling of the flow channel were considered. Results indicate that distributed and lumped mathematical models can be used to describe flow channel dynamics.
Author (TAB)

N70-36334# Michigan Univ., Ann Arbor. Cavitation and Multiphase Flow Lab.
A HIGH SPEED PHOTOGRAPHIC STUDY OF CAVITATION BUBBLE COLLAPSE
Charles Lee Kling (Ph.D. Thesis) Mar. 1970 233 p refs
(Contract DAHC04-67-C-0007; Grant NSF GK-730)
(AD-705375; Rept-03371-2-T; Rept-08466-7-T) Avail: CFSTI CSCL 20/4

The objective of the investigation was to determine the relationship between the form taken by the collapse of a cavitation bubble moving near a solid surface and damage to that solid surface. The movement of a collapsing bubble, collapsing with spherical symmetry toward a solid wall was analyzed assuming a potential flow field, and using the method of images, programmed on an analog computer.
Author (TAB)

N70-36377*# Purdue Univ., Lafayette, Ind. Gas Dynamics Labs.
WATER DROPLET BREAKUP IN HIGH SPEED AIRSTREAMS
Arthur A. Ranger and J. A. Nicholls (Mich. Univ., Ann Arbor) [1970] 30 p refs
(Contract NASr-54(07))
(NASA-CR-112406) Avail: CFSTI CSCL 20D

Experimental data on the shattering of water droplets in supersonic airstreams is presented. Water droplets, created by using a vibrating capillary technique, were introduced into the test section of a shock tube where they interacted with the convective flow established by the passage of an incident shock wave. A series of experiments are described in which the initial droplet diameter, convective flow Mach number, and airstream density were systematically varied to obtain results covering a wide range of aerodynamic conditions. High speed photographic techniques utilizing both image converter and rotating drum type cameras were used to photograph the disintegration process in its entirety. The data obtained from the photographs are presented and interpreted to yield such quantities as the breakup time and distance, the drag coefficient, and the secondary droplet (or residue) size. Correlations are presented which indicate that the results can be analyzed in terms of a nondimensional breakup time.
Author

N70-36389# Harvard Univ., Cambridge, Mass. Acoustics Research Lab.
VAPOR CAVITY FORMATION IN LIQUIDS
Robert E. Apfel Feb. 1970 225 p refs
(Contract N00014-67-A-0298-0007)
(AD-704593; TM-62) Avail: CFSTI CSCL 20/4

The work is devoted to the experimental and theoretical study of vapor cavity formation in pure and impure liquids. A novel experimental technique was developed for studying the properties of liquids under conditions that are not ordinarily accessible. This technique involves the use of an acoustic standing wave field established in a column of one liquid in order to trap an immiscible droplet of another liquid. In this experiment an either droplet suspended in glycerine was superheated and acoustically stressed until the combination produced an explosive liquid-to-vapor phase transition. The measured trade-off between tensile stress and superheat as causes of this vapor cavity formation is in gratifying agreement with the theory of homogeneous nucleation in liquids. The theoretical efforts go beyond this study of nucleation in pure liquids to consider the nucleation of vapor cavities from imperfectly wetted solid impurities (motes) in liquids. The qualitative conclusions of this theory bring some semblance of order to a wide variety of observations of statically-induced cavitation and low-frequency acoustic cavitation reported in the literature. A theory for the frequency dependence of the acoustic cavitation threshold, based on numerical solutions for the motion of a vapor cavity in a viscous, incompressible liquid subjected to an acoustic field, also yields results consistent with the available experimental data.
Author (TAB)

N70-36392# Eidgenossische Technische Hochschule, Zurich (Switzerland).
FLOW FORM, VAPOR VOLUME COMPONENT, AND PRESSURE DROP IN TWO PHASE WATER-VAPOR PIPE FLOW [STROEMUNGSFORM, DAMPFVOLUMENANTEIL UND DRUCKABFALL BEI ZWEIPHASENSTROEMUNG VON WASSER-WASSERDAMPF IN ROHREN]
Ahmet Kuetuekcueoglu (Ph.D. Thesis) Duesseldorf 1969 150 p refs In GERMAN
(Diss-4307) Avail: CFSTI

Vapor volume and pressure drop measurements in a pipe of 10 mm diameter are performed in order to evaluate the discrepancy between theoretical and observed two-phase flow values in high pressure water-vapor pipe flows. Considered are the individual effects of pressure, mass flow density, vapor mass component, flow direction, path length, and heat transfer. Results show that higher vapor flow densities and mass flow proportions induce circular flow which in turn accelerates vapor phase flow in comparison to the fluid. This leads to a phase distribution with lower vapor content than at homogeneous mixing of both phases and induced a pressure difference.
Transl. by G.G.

N70-36476# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TURBINES AND JET NOZZLES WITH TWO-PHASE FLOWS
V. D. Venediktov 3 Oct. 1969 254 p refs Transl. into ENGLISH from Turbiny i Reaktivnye Sopla na Dvukfaznykh Potokakh (USSR), 1969 p 1–195
(AD-700341; FTD-MT-24-202-69) Avail: CFSTI CSCL 20/4

Peculiarities of the operation of turbines and jet nozzles with two-phase working substances are examined. The method of successive approximations is used to investigate the flow in a nozzle of two-phase flow containing small particles, taking into account high-speed and temperature lag of the particles of gas; results of calculations on an electronic computer are given, which allow estimating rapidly the basic parameters of outflow of the two-phase flow from the nozzle. It is shown that the presence of a liquid wavy film on the wall of the nozzles leads to considerable losses in the boundary layer and causes considerable lowering of the efficiency of the nozzle. Given in the book is the method of calculation of turbines with two-phase flows with liquid particles, and the basic forms of additional losses are examined—because of the impact

of liquid particles against the rotor blades and due to friction against the wavy film covering the surface of the blading. To decrease the losses during impact of the particles against the blades, it is expedient to increase the axial clearance between the nozzle box assembly and the rotor wheel; with this erosional wear of the moving blades decreases. Author (TAB)

N70-36489# Cornell Aeronautical Lab., Inc., Buffalo, N.Y. Aerodynamic Research Dept.
RESEARCH ON NONISENTROPIC GAS DYNAMICS Final Scientific Report, 1 Jan. 1965 – 31 Dec. 1968
Robert J. Vidal, John A. Bartz, and Gordon E. Merritt Jan. 1970 38 p refs
(Contract AF 49(638)-1433)
(AD-705855; CAL-AF-2041-A-6; AFOSR-70-0524TR) Avail: CFSTI CSCL 16/3

The four problems that were investigated are (1) the development of a probe to measure molecular speed ratio and its application in nozzle flows and free-jet expansions, (2) surface measurements (heat transfer, skin friction, and surface pressure) on a sharp flat plate and on wedges in hypersonic flows in the transition from free-molecule to continuum flow, (3) pseudo-transpiration at an orifice and its effect on measured pressures, and (4) studies using speed-ratio probes to determine the structure of the viscous shock layer on a sharp flat plate. The report summarizes the results of those investigations. Author (TAB)

N70-36499# Naval Postgraduate School, Monterey, Calif.
AN ANALYTICAL STUDY OF SEPARATED FLOW ABOUT A CIRCULAR CYLINDER
Martin Dorner Davis (M.S. Thesis) Dec. 1969 135 p refs
(AD-704512) Avail: CFSTI CSCL 20/4

The problem of separated flow about a circular cylinder is studied analytically through the use of two potential flow models. Following a detailed review of the present state of knowledge, mathematical formulation of the models and appropriate computer programs are presented. These models are shown to be capable of simulating the asymmetric vortex shedding. Author (TAB)

N70-36518# Naval Postgraduate School, Monterey, Calif.
A PHOTOGRAPHIC INVESTIGATION OF BUBBLE NUCLEATION CHARACTERISTICS
Roger Lee Sowersby (M.S. Thesis) Dec. 1969 67 p refs
(AD-706051) Avail: CFSTI CSCL 20/4

The characteristics of bubble nucleation, growth, and departure during nucleate boiling were investigated. The liquid-vapor interface motion was analyzed using high speed motion picture photography. The fluids used were: distilled water, water with wetting agent, water with sucrose, ethanol, and freon-11. Cylindrical, conical, and reentrant cavity geometries were employed in addition to J, L, and I shaped capillaries. Cavity inner diameters were fixed at 0.085 centimeters and cavity depth ranged from 0.230 to 0.703 centimeters. Consistent results were obtained for geometrically similar cavities and for the same cavity at different occasions. A thin liquid film was observed on the cavity inner wall which was directly related to cavity nucleation stability. The liquid-vapor interface penetration was shown to be dependent upon cavity geometry and fluid properties. Frequency, but not penetration, was affected by heat flux and superheat. Author (TAB)

N70-36534# Naval Postgraduate School, Monterey, Calif.
AN EXPERIMENTAL INVESTIGATION OF THE STABILITY OF POISEUILLE FLOW
Richard Evans Westbrook (M.S. Thesis) Dec. 1969 65 p refs
(AD-705071) Avail: CFSTI CSCL 20/4

A theoretical and experimental investigation of the stability of developing laminar flow in a circular pipe subjected to small, rotationally symmetric (torsional) disturbances is presented. Analytically, developing mean velocity profiles were represented in polynomial series form and subsequent formulations yielded determinations on stability which reduce to the classical conclusions for the case of fully developed flow. Experimentally, torsional disturbances were imposed upon a developing laminar pipe flow by sinusoidally rotating a 1.5 inch (1 diameter) length of pipe in the entrance region of a carefully constructed wind tunnel facility. For flows with maximum Reynolds numbers of 8500, maximum amplitude and frequency of oscillation were 1/2 inch and 30 Hz., respectively. Hot wire anemometer measurements verified the stability of the developing flow field. Moreover, measured wave speeds and decay factors compare favorably to calculated values. Author (TAB)

N70-36580# National Engineering Lab., Glasgow (Scotland).
INVESTIGATION OF A CAVITATING FILM EROSION TEST
W. C. Brunton, J. M. Hobbs, and A. Laird Sep. 1969 19 p refs
(NEL-431) Copyright. Avail: CFSTI

Tests have shown that by continuously replenishing the test liquid in the cavitating film the excessive temperature rise experienced in other similar tests is prevented. The moderate temperature rise that is obtained depends mainly upon the nature and flow rate of the test liquid. Erosion patterns obtained on stationary 16 mm (0.625 inch) diameter testpieces were well distributed and fairly uniform. Erosion rate reached an early maximum and then decreased with time. It decreased as the separation increased, was proportional to probe amplitude but was not significantly affected by small pressure changes or by the rate of flow of test liquid. Optimum test conditions were obtained with 0.5 mm separation from a 20 kHz (kc/s) vibrator having a peak-to-peak amplitude of 50 micrometers (0.002 inch). Rates of erosion of widely different materials were about half of those obtained in a conventional open beaker test. The test offers distinct advantages over the open beaker test, especially with regard to the evaluation of weak materials and the control of the test liquid condition in the cavitation zone. Author

N70-36590*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
APPROXIMATION FOR DISTRIBUTION OF FLOW PROPERTIES IN THE ANGLE-OF-ATTACK PLANE OF CONICAL FLOWS
Joseph W. Cleary Washington Aug. 1970 37 p refs
(NASA-TN-D-5951; A-3615) Avail: CFSTI CSCL 20D

A simple approximation is made for the hodographs of stagnation-line streamlines in the angle-of-attack plane of conical flows that yields explicit equations for distributions of velocity and flow angle. It is assumed that shock angle and surface inclination are known and the flow is inviscid and isentropic. Comparisons with exact numerical solutions of the flow over right-circular cones demonstrate agreement over a wide range of cone angles and angles of attack for Mach numbers from one to infinity. Author

N70-36595*# Southwest Research Inst., San Antonio, Tex.
PROPELLANT DYNAMICS PROBLEMS IN SPACE SHUTTLE VEHICLES
H. Norman Abramson, Franklin T. Dodge, and Daniel D. Kana *In* NASA. Lewis Res. Center Space Transportation System Technol. Symp., Vol. 2 Jul. 1970 p 59–77 refs (See N70-36595 20-32)
(Contract NAS1-9891)
Avail: CFSTI CSCL 20D

The dynamic behavior of liquid propellants is considered in launch vehicles and spacecraft. Large masses of propellants, contained in nonaxisymmetric tanks and subjected to many varying forms and levels of acceleration, lead to slosh forces of such

magnitude as to require extensive baffling or lead directly to other important dynamic loads by interaction or coupling with the elastic structure. Some of these problems are presented and the directions in which preliminary efforts are being made to delineate the problems in more detail or to effect their solution are indicated. Author

N70-38689# Technische Hochschule, Karlsruhe (West Germany).
TRANSPORT OF SOLIDS BY PIPELINE Annual Report, 1 Apr. 1967 – 31 Mar. 1968
W. Staender Brussels EURATOM Jun. 1970 70 p refs In GERMAN; ENGLISH summary
(Contract EURATOM-105-66-4 IRAD)
(EUR-4495.d) Avail: CFSTI

The isotopic measurements of the hydraulic transport of solid materials are summarized. Special mention must be made of the measurement of the concentration distribution in the pipeline cross-section, by radiography, the preliminary tests in the peripheral zone and the construction of the erosion-test rig. Some theoretical considerations are propounded based on the measurement results, especially, the concentration measurements made with a gamma-probe. Differential equations are derived; the approximative solution of which enables the concentration profile to be reliably calculated in advance. The diagrams presented greatly facilitate the practical determination of the concentration profile. A comparison of the theory with the measurements carried out reveals a good measure of agreement. Author

N70-38853# Imperial College of Science and Technology, London (England). Dept. of Mechanical Engineering.
NUMERICAL SMEARING IN ONE-SIDED DIFFERENCE APPROXIMATIONS TO THE EQUATIONS OF NON-VISCOUS FLOW
M. Wolfshtein Oct. 1968 23 p refs
(EF/TN/A/3) Avail: CFSTI

The numerical smearing accompanying one-sided finite difference scheme for the solution of nonviscous flow problems is studied by numerical experimentation in uniform and radial velocity fields. It is shown that the smearing can be correlated in the form of a numerical diffusion. The numerical diffusion is found to be strongly dependent on the angle between the stream lines and the mesh. In general the numerical diffusion may become considerably smaller than an error analysis based on the Taylor series expansion suggests. Two one-sided finite difference schemes are compared. The numerical diffusion is smaller for this one which is conservative. Author

N70-38867# Imperial College of Science and Technology, London (England). Dept. of Mechanical Engineering.
THE PRANDTL-KOLMOGOROV MODEL OF TURBULENCE WITH THE INCLUSION OF SECOND-ORDER TERMS
B. E. Launder Nov. 1968 10 p refs
(BL/TN/2) Avail: CFSTI

A second-order form of the Prandtl-Kolmogorov shear stress model was derived by performing an analysis which took into account turbulent transfers arising through gradients in length scale. A momentum transfer equation is presented which is consistent with a mean velocity varying logarithmically with y near a wall. It implies that if du/dy is positive, the length scale is increasing with y, and the second derivative of the velocity profile is negative, the turbulent shear stress will fall to zero for a value of y less than that at which the mean velocity gradient is zero. This implication is in accordance with experimental measurements of developing wall jets and flow in rough and smooth surfaced ducts. J.M.

N70-38897*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Propulsion Div.
LIQUID PROPULSION *In its* Space Programs Sum. No. 37 – 62, Vol. 3 30 Apr. 1970 p 272 – 281 refs (See N70-38876 20-34)
Copyright. Avail: CFSTI CSCL 20D

The stabilizing effectiveness of baffles with the required degree of control over the combustion distribution is studied by controlling the hydrodynamic properties of the RC-1 injector. The dynamic stability of the engine was evaluated with an explosive-bomb technique, and the dynamic stability characteristics with various baffle lengths are summarized. It is concluded that for the baffle length (four-blade array), a high margin of stability is provided with 2.9- to 5.4-in baffles. F.O.S.

N70-38919# Imperial Coll. of Science and Technology, London (England). Thermofluids Section.
HEAT AND MASS TRANSFER IN RECIRCULATING FLOWS. LECTURE 3: COMPUTATION OF LAMINAR FLOWS
A. K. Runchal Dec. 1968 30 p refs Lecture presented at Post-Experience Course, London, 17 – 19 Dec. 1968
(EF/TN/A/7) Avail: CFSTI

The requirements for predicting laminar flows are presented with examples of the application of the predictions to various complex types of flow. The types of behavior encountered are given as convergence, oscillation, and divergence, and the causes of nonconvergence are discussed. The qualitative results of the numerical solution are considered to compare favorably with the Reiman dye-injection experiments. F.O.S.

N70-38920# Imperial Coll. of Science and Technology, London (England). Thermofluids Section.
HEAT AND MASS TRANSFER IN RECIRCULATING FLOWS. LECTURE 4: MODELS OF TURBULENT FLOW
D. B. Spalding Dec. 1968 30 p refs Lecture presented at Post-Experience Course, London, 17 – 19 Dec. 1968
(EF/TN/A/8) Avail: CFSTI

Turbulent flows are fitted into the general calculation scheme, and the various models of turbulent transport are discussed with the special practices for flows near walls. Periodic and quasi-steady flows are considered with the basic assumptions: (1) quasi-steady flows obey the laminar-flow equations, with augmented transport properties; (2) these transport properties depend on local fluid conditions; and (3) at any point, the value of the transport property is a scalar. Turbulent transport models are listed, and it is shown that the transport theories focus on the effective viscosity. The Prandtl mixing length Bradshaw, and Rotta theories are discussed. It is concluded that it is possible to predict heat and mass transfer in turbulent flows. F.O.S.

N70-38921# Imperial Coll. of Science and Technology, London (England). Thermofluids Section.
HEAT AND MASS TRANSFER IN RECIRCULATING FLOWS. LECTURE 5: COMPUTATION OF TURBULENT FLOWS
M. Wolfshtein Dec. 1968 32 p refs Lecture Presented at Post-Experience Course, London, 17-19 Dec. 1968
(EF/TN/A/9) Avail: CFSTI

Solutions for turbulent flows are presented that show the method is capable of predicting accurate turbulent flows, and indicate the suitability of the turbulence hypothesis. Turbulent flows discussed include: initial region of a wall jet, impinging jet, sudden enlargement in a pipe, and finned duct. F.O.S.

N70-38922# Imperial Coll. of Science and Technology, London (England). Thermofluids Section.
HEAT AND MASS TRANSFER IN RECIRCULATING FLOWS. LECTURE 6: STRUCTURE OF THE COMPUTER PROGRAMME
A. D. Gosman Dec. 1968 42 p refs Lecture presented at

Post-Experience Course, London, 17-19 Dec. 1968
(EF/TN/A/10) Avail: CFSTI

A computer program in FORTRAN 4 for solving laminar- and turbulent-flow problems is described with many of the subroutines applicable to both Cartesian and cylindrical polar coordinates. The principles of organization, flow charts, specification of the grid, storage of dependent variables, control of the order of iteration, and description of the problem solved by the program are given. Error analysis procedures are also given. F.O.S.

N70-36923# Imperial Coll. of Science and Technology, London (England). Thermofluids Section.

HEAT AND MASS TRANSFER IN RECIRCULATING FLOWS. LECTURE 7: FULLY DEVELOPED FLOW IN DUCTS

B. E. Launder Dec. 1968 25 p refs Lecture presented at Post-Experience Course, London, 17-19 Dec. 1968
(EF/TN/A/11) Avail: CFSTI

The general finite-difference procedure is used to obtain predictions of fully-developed flows in ducts. The fully developed flows are defined mathematically by elliptic differential equations, and guidelines are given for using general solutions to obtain the predictions. Some examples of predictions are demonstrated. F.O.S.

N70-36925# Imperial Coll. of Science and Technology, London (England). Thermofluids Section.

HEAT AND MASS TRANSFER IN RECIRCULATING FLOWS. LECTURE 9: FURTHER DEVELOPMENT OF THE METHOD OF COMPUTATION

D. B. Spalding Dec. 1968 32 p refs Lecture presented at Post-Experience Course, London, 17 – 19 Dec. 1968
(EF/TN/A/13) Avail: CFSTI

The applications, improvements, and extensions of the computer program for calculating heat and mass transfer are discussed. Several applications, and improvement areas are given. F.O.S.

N70-36954# Defence Research Establishment Suffield, Ralston (Alberta).

REMOVAL OF THE REFLECTED PRESSURE PULSES FROM THE END OF A SHOCK TUBE

W. A. Jones and F. L. McCallum Apr. 1970 28 p refs
(TN-257) Avail: CFSTI

Summary data of the development of a reflection eliminator to prevent positive or negative pressure pulses, generated by shock wave interaction with the end of a shock tube, propagating back up the expansion chamber is submitted. It is shown that both the reflected positive and negative pressure pulses can be reduced to a very small amplitude by a flat plate placed at a predetermined distance downstream of the open end of the expansion chamber, or by a screen with adjustable openings attached to the open end of the expansion chamber. Author

N70-37031# Union Carbide Corp., Oak Ridge, Tenn. Computing Technology Center.

NUMERICAL DESCRIPTION OF SUBSONIC FLOW IN A TURBULENT COMPRESSIBLE BOUNDARY LAYER

James E. Park 28 Apr. 1970 137 p refs
(Contract W-7405-eng-26)
(CTC-23) Avail: CFSTI

The use of digital computers to solve the fundamental equations of fluid mechanics is presently a developing art. An application of this technique to obtain a numerical description of the flow in a turbulent compressible boundary layer is described. A finite difference representation for the appropriate partial differential equations developed to describe the mean behavior of the turbulent flow was solved for free stream Mach numbers of 0.13 and 0.6. An empirical model for the turbulent stress tensor is presented. The restrictions necessary for numerical stability are noted. Iteration techniques, handling of numerical boundary conditions and similar problems are discussed. Satisfactory agreement is obtained between correlated experimental data from the literature and calculated local values for Nusselt number and friction coefficient. Calculated velocity profiles through the boundary layer are compared with measurements from the literature for the lower Mach number flow. From these results, it is concluded that flow in a turbulent boundary layer can be described numerically using the time marching technique. Author (NSA)

N70-37088*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CAVITY STABILITY DURING GAS JET IMPINGEMENT ON LIQUID SURFACES IN WEIGHTLESSNESS

Thomas L. Labus Washington Sep. 1970 12 p refs
(NASA-TN-D-5976; E-5712) Avail: CFSTI CSCL 20D

As a part of the continuing research into the behavior of liquids in weightlessness, an experimental investigation was conducted in a drop tower to determine the cavity stability characteristics for a laminar parabolic gaseous nitrogen jet impinging normally on a water surface. The critical velocity for cavity stability was correlated in terms of a critical modified Weber number and the Reynolds number. The contact angle on the test container surface was maintained at 90 deg such that the liquid-gas interface was completely flat during weightlessness. Author

N70-37120# New York Univ., N.Y. Geophysical Sciences Lab.

TRANSVERSE JET PLUMES Technical Progress Report, 1 Jan. 1969 – 31 Jan. 1970

James Halitsky and Edward J. Kaplin 31 Jan. 1970 27 p ref
(Contract AT(30-1)-3673)
(GSL-TR-70-4; NYU-3673-4) Avail: CFSTI

Wind tunnel tests were conducted to measure plume concentrations in a low-turbulence, steady air stream. Preparatory work included manufacture of a support rig for holding multiple sample probes, design and construction of a recording ohmmeter for rapid impinger analysis, and development of a new calibration curve for the shorter sampling period. A mathematical model has been written to generate a time mean plume for a turbulent atmospheric wind, using the low turbulence wind tunnel concentrations. NSA

N70-37181# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

TRANSONIC FLOWS WITH CHEMICAL RELAXATION [SUR LES ECOULEMENTS TRANSSONIQUES AVEC RELAXATION CHIMIQUE]

Roger Prud'homme 1969 102 p refs In FRENCH; ENGLISH summary
(ONERA-NT-148) Avail: CFSTI

The equations of a transonic flow with chemical reactions are first written assuming a quasi-one-dimensional evolution. These differential equations are solved for chemical equilibrium and near-equilibrium initial conditions. The problem of the flow-rate in a nozzle is examined. Napolitano's equations are recalled and a method for determining both approximate and exact solutions is given. The method of analysis is that of singular small perturbations around a basic uniform flow in chemical equilibrium. Author (ESRO)

N70-37182# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

APPLICATION OF A MIXING LENGTH SCHEME TO THE STUDY OF EQUILIBRIUM TURBULENT BOUNDARY LAYERS [APPLICATION D'UN SCHEMA DE LONGUEUR DE MELANGE A L'ETUDE DES COUCHES LIMITES

TURBULENTES D'EQUILIBRE]
Roger Michel, Claude Quemard, and Roland Durant 1969 59 p refs In FRENCH; ENGLISH summary
(ONERA-NT-154) Avail: CFSTI

A turbulence scheme, based on an improved mixing length concept was applied to equilibrium turbulent boundary layers. Assuming incompressible flow, the velocity profiles of a boundary layer submitted to both a pressure gradient and a fluid transfer at the wall were determined as were the effects of these two parameters on the wall friction. This treatment was extended to the compressible case. Laws were established for the velocity and enthalpy profiles and it is shown that pressure gradients have a considerable influence on the value of the Reynolds analogy factor. Author (ESRO)

N70-37197# Tetra Tech, Inc., Pasadena, Calif.
AN INTRODUCTION TO HYDRODYNAMICS AND WATER WAVES. VOLUME 1: FUNDAMENTALS
Bernard Le Mehaute Jul. 1969 239 p
(PB-192066; ESSA-TR-ERL-118-Vol-1; POL-3-1-Vol-1) Avail: CFSTI CSCL 8/3

Contents: The basic concepts and principles of theoretical hydraulics: Motions of elementary fluid particles; The continuity principle; Inertia forces; Applied forces; Equations of Euler; Navier-Stokes equations; Stability of laminar flow; Turbulence; Mean motion; Mean forces; Reynolds equation; Flow in a porous medium; Bernoulli equation; Flow pattern; Stream function; Potential function; Generalization of the Bernoulli equation; The momentum principle and its application; Boundary layer, flow in pipes and drag. USGRDR

N70-37273# California Univ., Davis. Dept. of Water Science and Engineering.
MECHANICS OF FLOW IN OPEN CHANNEL SYSTEMS Summary Technical Report
J. Amorocho and Alan Babb Nov. 1969 15 p refs *Its* Paper No. 1040
(Grants OWRR B-037; OWRR W-113)
(PB-189954; W70-04298) Avail: CFSTI CSCL 13B

Flow phenomena in channel transitions and flow in the neighborhood of open channel gates and controls were studied in laboratory channels. Data were obtained on the variation of the energy losses for warped expansions at high Reynolds' numbers and criteria were established for corrections of incomplete similitude on model investigations of these configurations. Detailed analyses of the fluid mechancis of expansions were advanced with the study of conical shapes. These investigations involved the development of special laboratory techniques and the evaluation of the terms of the integrated equations of energy and momentum balance for the flow in the expending fields. The analysis of the results will lead to analytic methods for optimum transition design. USGRDR

N70-37303# Dartmouth Coll., Hanover, N.H. Thayer School of Engineering.
HIGH VELOCITY CONDENSATION IN STRAIGHT PIPES
Graham B. Wallis Oct. 1969 27 p refs
(Grant NSF GK-1841)
(PB-189805) Avail: CFSTI CSCL 20D

A theory is presented from which pressure and Mach number variations along a straight pipe in the presence of uniform condensation can be rapidly estimated. The theory predicts a possible continuous transition through a Mach number of unity and the presence of shock-waves in apparent agreement with experimental data. Various assumptions about the shear stress at the vapor-liquid interface are tested. At high Mach numbers the data appear to agree with the Reynolds flux theory. At lower Mach numbers the results lie between two extreme predictions which either ignore or account for the effect of waves on the condensate film. Further study of the data, however, reveals that at least some of the success of the theory is due to a fortuitous cancellation of various neglected effects. Author (USGRDR)

N70-37305# Dartmouth Coll., Hanover, N.H. Thayer School of Engineering.
ONE-DIMENSIONAL WAVES IN TWO-PHASE FLOW. PARTS 1 AND 2: COMPARISON BETWEEN THE THEORIES OF WALLIS AND BIOT
Graham B. Wallis and John E. Dobson Oct. 1969 60 p refs
(Grant NSF GK-1841)
(PB-189844) Avail: CFSTI CSCL 20D

A general mathematical method for analysing one-dimensional waves in two-phase flow is presented. Certain basic categories of wave motion are defined and described. Interactions between the various classes of waves are analysed and physical implications such as choking, instability and dispersion, are discussed. It is shown that the classical formulation of Biot is compatible with the particular results of Wallis for the case on non-dispersive, one-dimensional compressible waves. Author (USGRDR)

N70-37319# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE CONVERGENCE OF SUCCESSIVE APPROXIMATIONS WITH SPLITTING OF THE BOUNDARY CONDITIONS FOR THE SOLUTION OF A BOUNDARY VALUE PROBLEM FOR THE NAVIER-STOKES EQUATIONS
B. V. Pal'tsev [1970] 5 p ref Transl. into ENGLISH from Vychisl. Matem. Matem. Fiz., v. 10, no. 3, 1970 p 785-788
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Successive approximations based on an iterative method are considered in solving a plane stationary problem of viscous incompressible fluid motion in a smooth bounded domain. Linear split problems are obtained for each approximation and it is shown that the successive approximations converge to the solution. J.M.

N70-37327# Dartmouth Coll., Hanover, N.H. Thayer School of Engineering.
LAMINAR FLOW IN POROUS TUBES AT HIGH EXTRACTION RATES
Graham B. Wallis Jan. 1970 26 p refs
(Grant NSF GK-1841)
(PB-189703) Avail: CFSTI CSCL 20D

It is shown that stable mathematical solutions exist at high extraction rates. Both approximate and exact solutions (within computer accuracy) are derived. In order to obtain these results in practice it is necessary for the wall Reynolds Number, based on the extraction velocity, to be greater than approximately 40. This severely limits the tube lengths to which the results apply if the axial Reynolds Number is to be below 3000, the normal limit of laminar flow. However, it is suggested that high rates of extraction may remove the boundary layer rapidly enough to promote laminarization at much higher Reynolds Numbers and thus increase the range of practical importance of the results. Author (USGRDR)

N70-37328# Clarkson Coll. of Technology, Potsdam, N.Y. Dept. of Mechanical Engineering.
THE TURBULENT FLOW DUE TO A ROTATING DISK Final Technical Report
F. F. Erian Apr. 1970 71 p refs
(Grant NSF GK-3064)
(PB-191514) Avail: CFSTI CSCL 20/4

An experimental study of the basic structure of turbulent flow due to a rotating disk was conducted. The pertinent mean and statistical quantities were measured and the results compared with available data. A mathematical model was presented taking into consideration some of the experimental findings. The following information was reported: (1) the mean radial and tangential

velocities in the turbulent boundary layer; (2) the turbulent boundary layer development near the disk; (3) a scalar eddy viscosity coefficient determined from the measurement of one component of the Reynolds shear stresses; (4) distributions of the two other components of the Reynolds shear stresses and (5) a comparison between corresponding properties of the turbulent boundary layers over a flat plate and a rotating disk. Author (USGRDR)

N70-37335# General Electric Co., Schenectedy, N.Y. Knolls Atomic Power Lab.
THE CALCULATION OF STEADY TURBULENT FLOWS IN TWO DIMENSIONS
Stephen E. Ziemnaik (Univ. of Los Alamos, New Mex.) 1969 14 p refs Sponsored by AEC
(KAPL-P-3885) Avail: CFSTI CSCL 20/4

Incompressible turbulent flows are approximated by a set of partial differential equations describing the transport of momentum, turbulence kinetic energy, and decay or dissipation of turbulent kinetic energy. Prandtl's hypothesis is used to relate the eddy viscosity to the kinetic energy of turbulence and to a scale of turbulence. Experimental results in the literature provide mathematical closure by establishing a relationship between decay, scale, and turbulence kinetic energy. Numerical solutions are then obtained to these equations for flow through a two dimensional channel. Author (USGRDR)

N70-37342# Dartmouth Coll., Hanover, N.H. Thayer School of Engineering.
THE SEPARATED FLOW REGIME OF TWO-PHASE FLOW
Graham B. Wallis Sep. 1969 65 p refs
(Grant NSF GK-1841)
(PB-189804) Avail: CFSTI CSCL 20D

Contents: General theory; Gravity balanced by drag; Drag balanced by particle pressure; The sum of buoyancy and drag forces balanced by inertia; Interactions between buoyancy, drag, inertia and particle pressure; The Mach number; Interaction between buoyancy, drag and particle pressure; Apparent mass effects in one-dimensional two-phase flow. USGRDR

N70-37534# Michigan Univ., Ann Arbor. Cavitation and Multiphase Flow Lab.
SOME EFFECTS OF APPLIED STRESS ON EARLY STAGES OF CAVITATION DAMAGE
Dale J. Kemppainen and Frederick G. Hammitt Apr. 1970 32 p refs Presented at the 1970 Symp. on Fluid Mech. and Design of Turbomachinery, University Park, Pa., 31 Aug.–3 Sep. 1970
(Grant NSF GK-1889)
(PB-191251; Rept-01357-16-T) Avail: CFSTI CSCL 20D

A substantial decrease in the number density of small pits in the early portion of a test was found when the materials were subjected to an external compressive stress. There was little difference between tests run under compression between the mercury facility and the vibratory facility. The application of a tensile load in both the mercury facility and the vibratory facility caused very little or no difference in the amount of damage compared to that while under zero load. Photographic investigation of individual pits shows that they are approximately circular. The photographs strengthen the hypothesis that these pits result from the impact of liquid microjets generated during bubble collapse rather than by spherical shock waves radiating from the center of collapse. Author (USGRDR)

N70-37556*# Agence Tunisienne de Public-Relations, Tunis.
THE COMPLETE WORKS OF LEONHARD EULER [LEONHARDI EULERI OPERA OMNIA]
Andress Speiser, ed., et al Washington NASA Aug. 1970 150 p refs Transl. into ENGLISH of the publ. 'Second Series, Mechanical and Astronomical Works,' Vol. 12 Lausanne, Soc. of Nat. Sci. of Switz., 1954 Sponsored by NSF and NASA
(NASA-TT-F-13278; TT-70-58041) Avail: CFSTI CSCL 20D

The principles on which the science of the equilibrium of fluids is based are developed. Fluids which have the same degree of density everywhere and which are incompressible, as well as other fluids composed of particles of different densities, are considered. The study includes the force of gravity and any other forces to which the fluid particles are subjected. Mathematical principles are derived to illustrate the forces acting on fluids. R.B.

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N70-36214 National Lending Library for Science and Technology, Boston, Mass.
PRESENT SEA ICE AND GLACIATION TENDENCIES AND SOLAR ACTIVITY
V. N. Kuniecki 24 Jun. 1970 9 p refs Transl. into ENGLISH from Izv. Vses. Geog. Obsc. (USSR), no. 101, 1969 p 428–432
(NLL-M-9214-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The relation between glacial growth and retreat with solar activity over the last three centuries is studied. Glaciers in North America, Greenland, Iceland, Norway, the Alps, the Caucasus, and the Altai were considered. It was found that when solar activity is high, all glaciers except the Alpine ones retreat more rapidly. When solar activity is low, rates of retreat fall to zero. Forecasts based on the alternation of 44-year solar cycles indicate a sharp fall in solar activity at the end of the 20th century. Concurrently, the glacial retreat in the 20th century has already been observed to slowed nearly to a stop. With the further fall in solar activity, the growth of Arctic glaciers is expected to be stabilized, indicating substantial changes in atmospheric circulation and climate. It is also predicted that there will be an increase in the ice cover of the Arctic seas, a rise in the level of the Caspian Sea, and a fall in the level of the Aral Sea. N.E.N.

N70-36223# Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia). Geophysical Branch.
NORTH BOWEN BASIN GRAVITY SURVEY, QUEENSLAND 1963
F. Darby 1969 78 p refs
(Rept-138) Avail: CFSTI

Results are presented for the 1963 helicopter gravity survey of the eastern part of Central Queensland. The Bouguer anomaly features of the Drummond Gravity Shelf correspond to broad regional features within the Drummond Basin. The Anakie Regional Gravity High corresponds to the Anakie Structural High. The Bowen Regional Gravity Low is correlated with the Bulgonunna Volcanic Block and the Bowen Basin. The Coastal Gravity Complex is related to this central uplift, into which large ultrabasic masses were emplaced prior to uplift and large granitic batholiths were emplaced during uplift. Author

N70-36230# Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia). Geological Branch.
GEOLOGY OF THE HODGKINSON AND LAURA BASINS, NORTH QUEENSLAND
F. de Keyser and K. G. Lucas 1968 254 p refs
(Bull-84) Avail: CFSTI

The results of systematic geological mapping in north Queensland, Australia by joint field parties during the period 1958 to 1963 are presented. The Hodgkinson Basin is a Paleozoic geosyncline and includes part of the western Precambrian borderland, which is separated from the geosyncline by the Palmerville Fault, a large fundamental structure. The Precambrian borderland consists of metamorphosed and granite-intruded gneiss, schist, and amphibolite. The Paleozoic geosyncline is assumed to have been initiated during the late Silurian, when the Palmerville Fault system developed as a hinge zone east of which the eroded Precambrian surface gradually subsided. Based on the mapping studies, the development of the two basins during each geological period is discussed. Author

N70-36237# New York, N.Y. Geophysical Sciences Lab.
ORBIT UNCERTAINTY AND SEA-SURFACE ALTIMETRY
Frederick C. Jackson Mar. 1970 35 p refs
(Contract N62306-68-C-0249; N62306-70-A-0075)
(AD-705268; GSL-TR-70-5) Avail: CFSTI CSCL 8/5

The extent to which unknown disturbances in orbit will affect the accuracy of an altimeter-derived geoid is investigated. A simple perturbation scheme is developed to examine the effects of isolated geopotential anomalies on a 600 km satellite in circular polar orbit. Hypothetical geoid undulations representing two different scales of anomalous geopotential are expanded in zonal harmonics. The resulting perturbations are analyzed and contrasted to the sea-surface (geoid) profiles. It is found that short-period fluctuations caused by mesoscale anomalies will amount to a few percent of the undulation amplitude; orbital-period fluctuations are likely to be ten times as large. Strong microscale anomalies such as those correlative to deep ocean trenches will cause disturbances on the order of 1 to 2 cm. It is concluded that with dense tracking (several fixes per revolution) overall errors in geocentric radius can be kept below 1 m; errors in computed orbit will not prevent the detection of sea-surface features of decimeter height, provided their scales are sufficiently small. Author (TAB)

N70-36240# Naval Oceanographic Office, Washington, D.C.
VERTICAL CIRCULATION OF WATER IN THE NORTH TROPICAL AND EQUATORIAL ZONES OF THE PACIFIC OCEAN [VERTIKALNAYA TSIRKULYATSIYA VOD V SEVERNOY TROPICHESKOY I EKVATORIALNOY ZONAKH TIKHOGO OKEANA]
R. R. Belevich 1970 78 p refs Transl. into ENGLISH from Tr. Gos. Okeanogr. Inst. (USSR), v. 90, 1967 p 3–61
(AD-704669; NOO-Trans-46421) Avail: CFSTI CSCL 8/3

The vertical circulation of water in the north Tropical and Equatorial Zones of the Pacific Ocean is discussed. Calculations are based on observational data obtained by various expeditions. The vertical water movements are charted for winter and summer in surface, subsurface and intermediate water layers of the Tropical and Equatorial Zones of the Pacific Ocean. The intensity and seasonal variations of vertical velocities are evaluated. The results are supported by a number of indirect factors. Author (TAB)

N70-36288# Massachusetts Inst. of Tech., Cambridge.
OCEANOGRAPHIC RESEARCH AT MIT IN THE DEPARTMENT OF EARTH AND PLANETARY SCIENCES AND THE DEPARTMENT OF METEOROLOGY Annual Report, 1 Jan.–31 Dec. 1969
Robert C. Beardsley, Shawn Biehler, Frederick A. Frey, Delbar P. Kelly, Erik Mollo-Christensen et al Mar. 1970 73 p
(Contracts Nonr-1841(74); N00014-67-A-0204-0204; Grant NSF GA-1439)
(AD-704604; MIT-70-3) Avail: CFSTI CSCL 8/3

Contents: Ocean-island interaction; Ocean circulation model studies; Ocean bottom pressure fluctuations one-shot float program; Inertial techniques; Marine gravity; Mechanics of sediment ripples and sand waves laboratory studies of shoaling internal gravity waves; Geochemistry of Mid-Atlantic ridge sediments; Heat flow data in northern horse latitudes; Heat flow in the North Atlantic at 43 degrees N; Magnetotelluric measurements in the deep ocean; Regional geophysics studies; Aeromagnetic tests for continental drift in Africa and South America; Heat flow measurements on the Reykjanes Ridge; Measurement and interpretation of heat flow in the Eastern Mediterranean and Black Seas; Heat flow between the Caribbean Sea and Mid-atlantic Ridge; Crustal structure of the Southern California continental borderland from gravity anomalies; Crustal structure from gravity anomalies in the Southwest Pacific; Topography and tectonics at the intersection of fracture zones with central rifts; and Dynamics of the small scale processes in air-sea interaction. TAB

N70-36278# Hawaii Inst. of Geophysics, Honolulu.
[PHYSICAL OCEANOGRAPHY, MARINE GEOPHYSICS AND GEOLOGY, AND CHEMICAL OCEANOGRAPHY] Semiannual Progress Report, 1 Jul.–31 Dec. 1969
31 Jan. 1970 82 p refs
(Contract N00014-70-A-0016-0001)
(AD-704539; HIG-70-4) Avail: CFSTI CSCL 8/10

Progress on work done under each of 3 tasks (1 Physical Oceanography, 2 - Marine Geophysics and Geology, and 3 - Chemical Oceanography) are reported for subject contract. The work described under (1) deals with subsurface current measurements in the vicinity of the Hawaiian Islands and the development of a tracking system for surface buoys. Under (2) results are described for crustal refraction measurements using sonobuoys and the Columbia University bottom seismic observatory off Point Arena, California, as receiving stations; the results for sparker, 3.5 kHz, 12 kHz, air gun, and explosive reflection and refraction measurements taken on the 1968-69 cruise to the Solomon Islands area; core analyses; heat flow, gravity, magnetic, and paleomagnetic data obtained on the same cruise. Under (3) the results of carbonate studies of sea water in the Pacific area are described. Author (TAB)

N70-36303# Hawaii Inst. of Geophysics, Honolulu.
FLIGHTS WITH AIRBORNE RADIATION THERMOMETERS IN HAWAIIAN WATERS
Klaus Wyrtki Feb. 1970 36 p refs
(Contract Nonr-3748(06))
(AD-704538; HIG-70-5) Avail: CFSTI CSCL 8/10

During August 1968 nine flights with airborne radiation thermometers were made over the waters west of the island of Hawaii with the purpose of locating the cold spots formed in the centers of cyclonic eddies. Such cold spots were observed and found to be drifting westward at rates of between 2 and 7 miles per day. During the later part of the flights the formation of a new cold spot was observed. It appears, however, that the upwelling in the center of the eddies is not the only source of the cool water but that advection of cool water and cooling by evaporation due to strong winds are also contributing factors. Author (TAB)

N70-36318# Harvard Univ., Cambridge, Mass. Lab. for Computer Graphics and Spatial Analysis.
GEOGRAPHY AND THE PROPERTIES OF SURFACES. SOME THOUGHTS ON OPTIMAL MAPPING AND CODING OF SURFACES Interim Report
Thomas K. Peucker 3 Nov. 1969 16 p refs *Its* Papers in Theoret. Geography No. 34
(Contract N00014-67-A-0298)
(AD-704518; ONR-TR-34) Avail: CFSTI CSCL 8/2

Geographers have spent a large part of their time and effort to refine techniques of presenting surfaces of different kinds. Manually produced maps were the usual device. This kind of preparation was appropriate for most purposes as long as the number of maps demanded did not surpass the abilities of the total number of cartographers and draftsmen. In many cases manual preparation is no longer possible. Applicable spatial data are now available to an extent which surpasses all imaginable bounds. This demands new methods of automated data handling, typically separating the process of storage and retrieval of data. This paper will discuss certain points which apparently were not considered in previous studies of systems for automated storage and retrieval of spatial data. Author (TAB)

N70-36327# Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia). Geophysical Branch.
STRANGWAYS RANGE DETAILED AEROMAGNETIC SURVEY, NORTHERN TERRITORY 1965
D. B. Tipper 1969 30 p refs
(Rept-136) Avail: CFSTI

A detailed aeromagnetic survey over five areas in the Strangways Range, to the north and north-northeast of Alice Springs, was made. A total of 115 square miles was surveyed with the primary purpose of outlining possible extensions to known copper and apatite deposits and discovering any anomalous areas nearby. A secondary aim of the survey was to assist geological mapping. Regional and local geology are described. The operational details of the survey and an outline of the interpretation methods employed are given. Of the sixteen known mineral occurrences, five were found to have strong magnetic expression, three others are probably correlated with two magnetic anomalies, and a further two occurrences are very close to a fault interpreted from the magnetic data. Many other anomalies were recorded in all areas, and the majority are due to bodies that either crop out or are within 50 feet of the surface. Many, if not most, of these bodies are believed to be steeply dipping lenses and prismatic bodies of amphibolite interjacent with less magnetic gneissic and schistose rock. Thirty-one faults are interpreted, many of which coincide with photolinear features, and three fold structures are tentatively proposed. Author

N70-36328# Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia). Geophysical Branch.
DALY RIVER DETAILED AEROMAGNETIC SURVEY, NORTHERN TERRITORY 1966
E. P. Shelley 1969 51 p refs
(Rept-139) Avail: CFSTI

During September 1966, a detailed aeromagnetic survey over 55 square miles of the Daly River Mineral Field was made. The area is located on the north side of the Daly River about 90 miles south-southwest of Darwin. The aims of the survey were to determine the source and extent of the copper mineralization and generally to assist geological mapping in areas of alluvial cover. Many magnetic anomalies were quantitatively analyzed, and the depths, dimensions, attitudes, and compositions of the bodies causing them are discussed in relation to the geological structure of the area. No anomalies can be directly correlated with the main localities, but anomalies occur over Warrs Mine and the Knowles Farm area. A prominent magnetic lineation that occurs between the mining localities is thought to be due to a dolerite body, which may be the source of the mineralization. The magnetic contour pattern delineates a south-plunging anticlinal structure in the southwest of the area. The source of the lineations is thought to be a series of basic intrusives folded with the sediments. Author

N70-36344 National Lending Library for Science and Technology, Boston Spa (England).
THE PROBLEM OF AVERAGING IN THE MEASUREMENT OF HYDROMETEOROLOGICAL FIELDS
N. N. Verencikov 9 Apr. 1970 11 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Obs. (Leningrad), no. 221, 1968 p 158–166 (NLL-M-9107-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

Supplemental data are given for determining the optimum averaging interval for a hydrometeorological element. In addition, the variability of averaged values of a hydrometeorological element are calculated. Parameters considered include: the radius of representation of measurements, the error in interpolating an element from discrete averaged measurements, and the distance between measurement points required for a given maximum error of interpolation. E.M.C.

N70-36347# Air Force Cambridge Research Labs., Bedford, Mass. Aeronomy Lab.
HELICITY REPRESENTATIONS OF THE COORDINATE, MOMENTUM, AND ANGULAR MOMENTUM OPERATORS
Scientific Interim Report
Harry E. Moses Jan. 1970 59 p refs
(AD-704553; AFCRL-PSRP-409) Avail: CFSTI CSCL 4/1

The report presents certain new mathematical techniques useful in the analysis of upper atmospheric chemical processes. Non-relativistic systems of particles always have among their dynamical variables the operators X sub i(i = 1, 2, 3) which characterize the position of the center of mass, the operators P sub i which characterize the total momentum of the system, and the angular momentum operators J sub i. In the present paper all the operators were found which satisfy the quantum mechanical commutation relations. Various bases are discussed and representations of these operators are given in these bases. Applications to scattering theory are discussed. Author (TAB)

N70-36354# Joint Publications Research Service, Washington, D.C.
OCEANOGRAPHY
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No. 233 29 Jul. 1970 p 12–17 (See N70-36351 20-34)
Avail: CFSTI

News items and abstracts of articles are presented on exploration for coastal placers, cruises of scientific research ships in various oceans, underwater research in the USSR, the degree of light polarization in turbid media, and the regionalization of the Pacific ocean floor for benthos foraminifera. R.B.

N70-36355# Joint Publications Research Service, Washington, D.C.
TERRESTRIAL GEOPHYSICS
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No. 233 29 Jul. 1970 p 18–28 (See N70-36351 20-34)
Avail: CFSTI

News briefs are reported on a conference on aerial surveying, a symposium on planetary geophysical research, a network of seismic stations in Tadzhikistan, a method for recording magnetic field variations, and a quartz astatic galvanometer. Summaries are given for using an analytical geomagnetic field in the study of magnetic anomalies, the statistical characteristics of anomalous gravity and magnetic fields, the diurnal variation in the polarization axis of Pcl pulsations, the Moho relief in the Black Sea basin, a proposal for a magnetotelluric network, the deep structure of the Crimea and the surrounding region, strata with reduced velocities in the Ukrainian Shield, new volcanic-sedimentary formations in the Kurile Islands, and correlation of crustal parameters in Turkmenistan. R.B.

N70-36369# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.
ON THE COMPUTATION OF PLUMBLINE DEFLECTIONS

AND QUASIGEOID HEIGHTS IN MOUNTAINS [O VYCHISLENII UKLONENII OTVESA I VYSOT KVAZIGEOIDA V GORAKH]

L. P. Pellinen Dec. 1969 29 p refs Transl. into ENGLISH from Tr. Tsent. Nauch.-Issled. Inst. Geodezii, Aerosemki i Karatograf (USSR), no. 176, 1969 p 98–112
(AD-703096; ACIC-TC-1587) Avail: CFSTI CSCL 8/5

The article gives a review of methods recommended for use in the computation of plumbline deflections and quasigeoid heights in mountains. It is confirmed that Arnolds formulas give a result identical to Molodenskiys first-approximation formulas. The Aronov-Bjerhammar method, in which the gravity anomalies are interpreted by a material layer at sea level, is recommended for separation of the anomalies regional part, after which the residual anomalies are interpreted by a material layer on the hypsometric surface. This review deals only with the methods that have been practically tested on models or in actual computations in mountain regions. Author (TAB)

N70-36474# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE PHYSICS OF WIND WAVES

V. V. Shuleikin 8 Oct. Transl. into ENGLISH from Zemlya i Vselennaya (USSR), no. 5, 1967 p 75–83
(AD-700347; FTD-MT-24-159-69) Avail: CFSTI CSCL 8/3

It is shown how dimensions of wind waves are calculated, based on a specified wind speed, time of its influence on the surface of the sea (or a lake), and assigned local conditions such as the depth of the sea, and the distance from shore from which the wind is blowing. TAB

N70-36483# Ohio State Univ. Research Foundation, Columbus. Dept. of Geodetic Science.

ANALYSIS OF CORRELATION BETWEEN FREE-AIR ANOMALIES AND ELEVATIONS

Urho A. Uotila Nov. 1969 84 p refs
(Contract F23601-67-C-0125)
(AD-704594; DGS-94) Avail: CFSTI CSCL 8/5

Extensive regression analyses have been made in 25 1 degree x 1 degree blocks with observed gravity data and corresponding elevations. Statistical hypotheses tests were attempted for making a decision when localized elevation correlations obtained through the least-squares solutions should be used instead of standard Bouguer coefficients in the prediction of free-air anomalies. Author (TAB)

N70-36497# Agricultural Research Service, Ithaca, N.Y. Soil and Water Conservation Research Div.

THE ENERGY BUDGET AT THE EARTH'S SURFACE. EFFECTS OF AIR TURBULENCE UPON GAS EXCHANGE FROM SOIL Interim Report

B. A. Kimball and E. R. Lemon Nov. 1969 139 p refs
(AD-705379; ECOM-2-68I-4; ECOM-2-68I-5; IR-69) Avail: CFSTI CSCL 2/3

An instrument to measure the rate of gas movement from beneath the surface of soil or other porous media was constructed. Subsequent measured rates of gas movement from beneath surface coverings of coarse and fine gravel, very coarse and medium sand, Chenango silt loam and straw were correlated against concurrent measurements of wind and air pressure fluctuations. At a depth of 2 cm gas movement in silt loam was not significantly affected by air turbulence but in coarse gravel was increased 10-fold by wind velocities of 400 cm/sec. Intermediate effects were observed for media of intermediated pore sizes. Mathematical equations for calculation of soil air mass flow are derived. They are based upon the spectrum of air pressure fluctuations at the ground surface. Air pressure in the field was measured during both day and night with and without a corn crop. The spectra of air pressure were calculated and all were roughly straight lines with a slope of about -6/3 on a log-log plot. Spectral density decreased from 10 to the 8th power to 0.10 sq microbar/cycle/sec over a frequency range from 0.0001 to 100 cycle/sec. Soil air mass flow was calculated from the spectra for several soils. Using previous work, an attempt was made to evaluate the increase of soil gas movement beyond diffusion from the soil air mass flow. Author (TAB)

N70-36514# Naval Postgraduate School, Monterey, Calif.

NEIGHBOR DIFFUSION IN MONTEREY BAY

B. J. Taylor, Jr. (M.S. Thesis) Oct. 1969 54 p refs
(AD-706059) Avail: CFSTI CSCL 8/3

The applicability of Richardsons four-thirds law to turbulent horizontal diffusion, the dependence of diffusion on the weight of the diffusers, and the effects of varying the rejection level of the data were investigated. Diffusers of identical size and shape but weighing 13 or 15 pounds were photographed from a Navy US2-A aircraft. The data were collected in Monterey Bay on scales from 25 meters to 200 meters, with water depths ranging from 220 to 270 feet. Author (TAB)

N70-36594# National Oceanographic Data Center, Washington, D.C.

REFERENCE SOURCES FOR OCEANOGRAPHIC STATION DATA

Charlotte Ashby and Carmen Johnson 1969 469 p refs
(AD-704861; NODC-PUB-C-1) Avail: CFSTI CSCL 8/10

The publication is a catalog of reference sources from where oceanographic station data (source material) available at the National Oceanographic Data Center were obtained. Author (TAB)

N70-36624# Atomic Weapons Research Establishment, Aldermaston (England).

SOME SEISMIC RESULTS OF THE US GASBUGGY AND RULISON UNDERGROUND NUCLEAR EXPLOSIONS

D. J. Corbishley Jun. 1970 11 p refs
(AWRE-O-46/70; Rept-3) Copyright. Avail: HMSO 2s; BIS $0.40

The seismic results obtained from the four UKAEA sponsored arrays at Eskdalemuir, Scotland; Yellowknife, Canada; Gauribidanur, India; and Warramuga near Tennant Creek, Australia are presented. These explosions were part of Project Plowshare, and were used to investigate the feasibility of releasing natural gas from impervious strata. Author

N70-36629# Eidgenossische Technische Hochschule, Zurich (Switzerland).

SIZE SPECTRUM ANALYSIS OF AEROSOLS IN THE AMICRONIC REGION [CONTRIBUTION A LA METHODOLOGIE GRANULOMETRIQUE DES AEROSOLS AMICROSCOPIQUES]

Andre Junod (Ph.D. Thesis—Lausanne Univ.) 1969 73 p refs In FRENCH; ENGLISH summary
(Rept-4280) Avail: CFSTI

A critical review of the physical principles involved in the size spectrum analysis of aerosols in the amicronic region (r < 0,01 micrometers). Methods based on the thermal diffusivity or on the electrical mobility of particles appear to be the most promising ones with regard to resolution and ease in processing the results. The electrical procedure achieves a faster response as well as a better selectivity. A new method of ionic spectrometry in which a modulated working voltage is used in order to get directly the second derivative of the ionic current with respect to voltage is described. This makes a purely experimental determination of the required distribution functions possible. After a theoretical account

A the procedure a description of a laboratory set-up designed to test the measuring principles follows. Four series of measurements were worked out and used to compare the respective merits of the purely experimental and of the numerical spectrometric methods. Concluding remarks point out some possible technical improvements of the proposed technique and its importance for the investigation of the atmospheric aerosol. Author

N70-36637# Institute of Technology, Helsinki (Finland).
THEORETICAL ACCURACY STUDIES ON THE ANALYTIC BLOCK ADJUSTMENT METHOD PRACTICED IN FINLAND [THEORETISCHE GENAUIGKEITSUNTERSUCHUNGEN DER IN FINNLAND ANGEWANDTEN ANALYTISCHEN BUENDELAUSGLEICHUNGSMETHODE]
Einari Kilpelae (Ph.D. Thesis) 1970 77 p refs In GERMAN
Avail: CFSTI

Evaluated are mathematical and stochastic models for precision stereo comparison procedures that require exact block adjustments of control points for analytical photogrammetry in large scale cartography. The general error propagation method is used to investigate both methods. It is found that the block adjustment method gives exact results for position coordinates in large scale cartography; the precision of the height determination was not exact enough and is especially sensitive against extrapolation. Distance accuracy varied in the block depending on distance, length and position. Precision of the outer orientation values for the picture increases with increased content of control points up to 25; the equal distribution of the control points is of utmost importance. Finally, a procedure for forging two blocks of equalized bundles is developed that uses repeated bundle adjustments of geodetic control points as well as newly developed control points. Transl. by G.G.

N70-36812*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE SUBAURORAL RED ARC AND THE ASSOCIATED IONOSPHERIC PHENOMENA
S. Chandra, E. J. Maier, B. E. Troy, Jr., and B. C. Narasinga Rao Aug. 1970 18 p refs
(NASA-TM-X-65307; X-621-70-310) Avail: CFSTI CSCL 04A

The phenomenon is described of the midlatitude red arc of September 29, 1967, through observations of the properties of the ionospheric plasma. The ion and electron temperatures, ion composition and density, and suprathermal electron flux during this period are measured by retarding potential analyzers near 900 km from OGO 4 and near 2000 km from Explorer 31. These parameters show the following changes in the region L = 2.3 to L = 3.0 during the red arc period as compared to their values during normal periods: (1) Electron and ion temperatures increase to above 4000 K from a normal value of 2000 K at 900 km, while at 2000 km electron temperature increases to above 5000 K from a normal value of 2500 K; (2) at 900 km the ratio of $O+/(H+ + He+)$ changes from 1 to 5 while the total density remains approximately the same; (3) at 2000 km the ion density decreases by a factor of 10 with the composition remaining all $H+$; (4) there is no significant increase in the flux of 5 – 10 ev electrons. The relative importance of electric field heating, magnetospheric conduction and the changes in the neutral composition in the lower atmosphere are examined in the light of these observations. It is concluded that the SARARC is caused by a combination of thermal conduction of energy from the magnetosphere and changes in the neutral composition in the lower atmosphere. Author

N70-36834# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
A RESTRAINT-FREE ADJUSTMENT OF THE WEST GERMAN PART OF THE EUROPEAN TRIANGULATION NET [EINE ZWANGSFREIE AUSGLEICHUNG DES WESTDEUTSCHEN ANTEILS AM EUROPAEISCHEN DREIECKSNETZ (RETrig)]
Dieter Ehlert 1969 99 p refs In GERMAN; ENGLISH summary *Its* Ser. B No. 171
(Rept-115) Avail: CFSTI

Presented are the results of a first geometric adjustment of the West German part of the European triangulation net. Author

N70-36835# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
THE SCHLESWIG-HOLSTEIN FIRST-ORDER SUPPLEMENTARY NETWORK [DAS SCHLESWIG-HOLSTEINISCHE ERGAENZUNGSNETZ I. O. IM NORDSEEKUESTENGEBIET]
Hans-Joachim Spiess and Hermann Dirk 1970 80 p refs In GERMAN; ENGLISH summary *Its* Ser. B, No. 174
(Rept-118) Avail: CFSTI

Described is the planning and performance of work connected with a German North Sea Coast Network, the so-called "Schleswig-Holsteinisches Erganzungsnetz 1.O." (Schleswig-Holstein First-Order Supplementary Network). This net has been designed as trilateration network with supplementary angular measurements and extended to the Braak base-extension net. The results of the angular observations and of the measured distances are given. Author

N70-36839# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
TELLUROMETRIC MEASUREMENTS PERFORMED AT THE INSTITUTE FOR APPLIED GEODESY ON THE WEST GERMAN MAIN TRIANGULATION NET FROM 1958 TO 1968 [DIE VON 1958 BIS 1968 IM WESTDEUTSCHEN HAUPTDREIECKSNETZ DURCHGEFUEHRTEN TELLUROMETERMESSUNGEN DES INSTITUTS FUER ANGEWANDTE GEODAESIE]
Eberhard Billich, Hermann Dirk, and Dieter Ehlert 1970 169 p refs In GERMAN; ENGLISH summary *Its* Ser. B, No. 175
(Rept-119) Avail: CFSTI

The results of tellurometric measurements made during the period 1958 to 1968 within the West German first-order triangulation net are reported. A total of 602 single measurements made on 152 triangle sides, diagonals, or sections of the net are described. The single measurements with their dates of observation are taken from the field logs and the mean values jointly reduced on a large-scale computer. Author

N70-36840# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Biology and Health Physics Div.
THE PERCH LAKE EVAPORATION STUDY
P. J. Barry and W. F. Merritt Feb. 1970 16 p refs Presented at the IAEA Symp. on the Uses of Isotopes in Hydrol., Vienna, 9 – 13 Mar. 1970
(AECL-3557; SM-129/10) Avail: CFSTI; Atomic Energy of Can., Ltd., Chalk River: $0.50

The primary purpose of the project is to exploit the use of radioactive tracers in the study of all aspects of the hydrological cycle in a small, well defined basin. A number of individual studies are being conducted of which one, the use of tritiated water vapor for the study of evaporation mechanisms in a natural setting, is believed to be unique. Other studies include the determination of the water, tritiated water, energy and trace element budgets of the lake of which the first three complement the use of tritiated water vapor to study basic evaporation mechanisms. Radioactive tracers were used particularly for estimating the ground water components of the water and tritium budgets. Ground water flows predicted by the use of conventional hydrological techniques as well as various new flow models are being compared with the results obtained using radioactive tracers. Author

N70-36842# Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia). Geological Branch.
SEDIMENTOLOGY OF THE UPPER DEVONIAN AND CARBONIFEROUS PLATFORM SEQUENCE OF THE BONAPARTE GULF BASIN
J. J. Veevers 1969 99 p refs /ts Bull. No. 109
Avail: CFSTI

The platform sequence consists of 12,000 feet of marine conglomerate, quartz sandstone, limestone, and minor shale, disconformable overlain by 350 feet of Upper Carboniferous terrestrial quartz sandstone with minor conglomerate and siltstone. The marine conglomerate is a marginal wedge, and consists essentially of well rounded fragments, up to boulder size, of metaquartzite and milky quartz in a matrix of quartz sandstone. The sandstone is a uniform argillaceous quartz sandstone with a pure orthoquartzite sand fraction, and occurs in two contrasting bed forms: cross-bedded and flat-bedded sandstone. Granulometric studies seem to confirm that these sands are marine. Carbonate rocks, chiefly limestone, were deposited during espisodes of reduced supply of coarse terrigenous sediments. From field evidence, the well exposed Famennian limestone is known to be a reef complex, and is characterized by distinctive assemblages of groups defined numerically by petrographic and chemical attributes. The persistence of reefal limestones indicates the maintenance of a delicate balance of conditions in the sea favoring reef growth. Author

N70-36866# Weapons Research Establishment, Salisbury (Australia).
BASIC ATMOSPHERIC PARAMETERS AS MEASURED BY FOUR FALLING SPHERE EXPERIMENTS AT WOOMERA, JULY TO NOVEMBER 1966
P. H. O. Pearson Feb. 1969 35 p refs
(WRE-TN-SAD-219) Avail: CFSTI

Seasonal variations of atmospheric density, temperature, pressure, and winds shortly after sunset measured by four falling sphere experiments are reported. Appended are meteorological conditions at range at time of firing in forms of graphs and tables. E.M.C.

N70-36900*# GCA Technology Div., GCA Corp., Bedford, Mass.
STUDY OF THE DYNAMICS AND IONIZATION OF THE UPPER ATMOSPHERE Final Report
L. G. Smith, J. Bedinger, and E. Constantinides Jul. 1970 52 p refs
(Contract NASw-1881)
(NASA-CR-112349; GCA-TR-70-3-N) Avail: CFSTI CSCL 04A

Simultaneous measurements of electron density profiles obtained with rocket borne Langmuir probes and wind profiles determined from vapor trails released from the same rocket were made at Wallops Island, Va. during the early morning of 22 February 1968. In addition to the usual features of the nighttime E region, a layer of enhanced electron density was observed to descend from 140 to 110 km during the six-hour period between midnight and sunrise. It is concluded that this layer probably occurs regularly in the E region at night, but is often blanketed by underlying layers and thus not recorded on iongrams. A simple theory of redistribution of ionization by horizontal winds accurately describes the motion of this layer. Application of the theory allowed determination of consistent values of the effective recombination coefficient and also revealed that the effects of electric fields were small during the observing period. In the lower E region, the winds produced relatively small ion drift velocities and layers of enhanced electron density were observed to persist for several hours. Author

N70-36906*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
NEW STATIC MODELS OF THE THERMOSPHERE AND EXOSPHERE WITH EMPIRICAL TEMPERATURE PROFILES
L. G. Jacchia 6 May 1970 93 p refs
(Grant NGR-09-015-002)
(NASA-CR-112684; SAO-Special-Rept-313) Avail: CFSTI CSCL 04A

The present models are patterned after similar models published by the author. The main differences consist in the lower height (90 km instead of 120 km) of the constant-boundary surface and in a higher ratio of atomic-oxygen to molecular-oxygen density (n(O)/n(O2) approximately 1.5 at 120 km instead of about 1.0). Mixing is assumed to prevail to a height of 105 km, diffusion above this height. All the recognized variations that can be connected with solar, geomagnetic, temporal, and geographic parameters are represented by empirical equations. Tables showing temperature, density, and composition as a function of height are given for exospheric temperatures ranging from 600 deg to 2000 K, at 100 K intervals, and for heights from 90 to 2500 km. A summary table at the end gives densities only for the same range of heights and temperatures, but at 50 K intervals in the exospheric temperature. A set of auxiliary tables is provided to help in the evaluation of the diurnal, geomagnetic, semiannual, and seasonal-latitudinal effects. Author

N70-36963# Lockheed Missiles and Space Co., Palo Alto, Calif.
DETERMINATION OF PARAMETERS OF THE ATMOSPHERE IN THE TRANSITION DOMAIN AT 80-120 km ALTITUDES
E. N. Golubev et al 1970 5 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow) v. 8, no. 3, 1970 p 467-470
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

A method is examined for computing the parameters of an undisturbed atmosphere, used in the case of measurements made on the surface of a blunt body moving at hypersonic velocities in various aerodynamic modes from free-molecule to continuum. Author

N70-36970# Weapons Research Establishment, Salisbury (Australia).
OZONE MEASURING TECHNIQUES AND THEIR ASSESSMENT FOR WRE DROPSONDE USE
N. V. Sissons Dec. 1968 22 p refs
(WRE-TN-SAD-198) Avail: CFSTI

Methods of measuring atmospheric ozone are assessed in regard to their application to the Weapons Research Establishment dropsonde system. It has been concluded that an optical method could be incorporated into the existing dropsonde system to measure ozone densities between 60 km and 30 km and this is discussed in some detail. Author

N70-36971# Weapons Research Establishment, Salisbury (Australia).
EXTINCTION OF A TANGENTIAL RAY, BY RAY TRACING THROUGH THE ATMOSPHERE
F. C. Hymus and K. H. Lloyd May 1969 46 p refs
(WRE-TN-HSA-152) Avail: CFSTI

The problem of determining the absorption of sun's rays passing tangentially through the atmosphere is solved. An exact solution is obtained by tracing the path of the ray through the atmosphere, and then computing the absorption along the path. Because the integrals which trace the path of the ray, and which give the absorption, cannot be evaluated analytically they must be integrated numerically. The Fortran program which does this integration is described, and some results obtained from it are presented. The necessary equations are developed, and the choice of model atmosphere and extinction parameters examined. The decrease of intensity due to refraction-divergence is included. Although the problems are discussed in terms of their application to twilight contaminant releases, the treatment is sufficiently general to be used for other problems. Author

N70-36989# Commissariat a l'Energie Atomique, Fontenay-aux-roses (France). Centre d'Etudes Nucleaires.

RADIOACTIVE POLLUTION BY RADON IN VERTICAL DRILL HOLES [POLLUTION RADIOACTIVE PAR LE RADON DANS LES FORAGES VERTICAUX]

Roland Bourseau, Pierre Fabre, and Edmond Zini May 1970 18 p refs In FRENCH; ENGLISH summary
(CEA-R-3965) Avail: CFSTI

This report reviews the problem of radioactive pollution by radon in exploration drill holes for uranium, and gives an estimate of the very small quantities of radon involved. It describes a method of determination using the changes, measurable by simple discrimination, produced in the whole gamma radiation spectrum from the ore in situ by a radon source situated in the vicinity of the measuring probe. The experiments can be carried out either in a dry environment or underwater. The quantity of radon present is defined by a coefficient expressed as a ratio varying from 1 to 3, between an ore in radioactive equilibrium and a radon source without ore, so enabling the amount of pollution to be evaluated. These results were obtained in the laboratory and must be checked in the field. Author (ESRO)

N70-36992# Coast and Geodetic Survey, Las Vegas, Nev. Special Projects Party.

RULISON SEISMIC EFFECTS

R. Navarro and G. Wuollet Rockville, Md. 16 Feb. 1970 145 p Sponsored in part by AEC
(CGS-746-2; PNE-R-23) Avail: CFSTI

The Rulison seismic signal was recorded in the distance range of from 4.29 to 366.3 km at 42 seismograph stations. The stations spanned four states with 84% of the stations located within a 145 km radius of ground zero in Colorado. The nuclear explosive had a yield of 40 kt (plus 20 or minus 4 kt). The recorded high frequency particle velocities were as predicted. Readily identifiable impulsive elastic waves with their arrival times are given. An average apparent propagational velocity of 5.2 km/sec for the initial p-phase was calculated in a range of 4.29 to 366.3 km. The earthquake occurrence rate of 0.7 earthquakes per day during the two months of recording after the event compared favorably with the 0.6 earthquakes per day before the event. NSA

N70-37007# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

STUDY OF THE FALLOUT OF ARTIFICIAL IRON-55: APPLICATION TO THE EVALUATION OF THE FALLOUT OF NATURAL IRON OF STRATOSPHERIC ORIGIN [ETUDE DE LA RETOMBEE DE FER-55 ARTIFICIEL: APPLICATION A L'ESTIMATION DE LA RETOMBEE DE FER NATUREL STRATOSPHERIQUE]

Chi Trach Hoang (Ph.D. Thesis—Paris Univ., 5 Mar. 1969) Feb. 1970 106 p refs In FRENCH; ENGLISH summary
(CEA-R-3918) Avail: CFSTI

Iron-55 fallout and the world balance of this radioelement were studied. This tracer enables one to calculate the input of natural iron of stratospheric origin on to the earth and the input through the atmosphere of natural iron to the oceans. It is shown (a) that iron-55 is produced in nuclear explosions according to the Fe-56(n,2n) Fe-55 reaction, (b) that the iron-55 fallout obeys a stratospheric pattern with a decay period between 9 and 11 months, (c) that the fallout is 3.5 times more important over the Eastern Northern Atlantic than over France. The world balance of the iron-55 fallout during 1962—1965 was computed by comparison with the strontium-90 fallout. It was 50 megacuries for the iron-55 introduced into the atmosphere, and 25.3 megacuries of it fell on the earth during that period. The input of natural iron of stratospheric origin to the earth was 6 million metric tons p.a. and the input through the atmosphere of natural iron to the oceans was 12 million metric tons p.a. Author (ESRO)

N70-37027*# Pittsburgh Univ., Pa. Graduate School of Public and International Affairs.

THE INTERNATIONAL ADMINISTRATION OF OCEAN RESOURCES. UNITED STATES POLICY TOWARDS MANAGEMENT OF DATA ORIGINATING IN ON OR NEAR THE DEEP SEA BED

Harry W. Little [1969] 27 p refs
(Grant NGL-39-011-080)
(NASA-CR-112771) Avail: CFSTI CSCL 08J

The goal of the United States data management system is discussed, along with the environmental and data management objectives, and priorities are suggested. Policy issues considered by the National Marine Council during 1968 are reviewed, with reference to their relevance to data management. Justifications for the global data system are summarized. Current practices, procedures, and requirements in the collection and dissemination of oceanographic environmental data are discussed, and problem areas in data management are suggested on both national and international levels. Management of data originating near the deep seabed is stated to be relatively independent both of national jurisdiction and of the international regime. It is recommended that the National Oceanographic Data Center, in its present form, be abolished, and that federal funding for a centralized comprehensive environmental data management system be focused on a single agency. The need for international cooperation and coordination of data is stressed. P.A.B.

N70-37049# Signals Research and Development Establishment, Christchurch (England).

NIGHT SKY RADIATION IN CANADA

D. Pardy Dec. 1969 21 p refs
(SRDE-69054) Avail: CFSTI

The series of measurements described in this report were made during comparisons of U.S., U.K., and Canadian night illumination equipment at Lac Montauban, Province de Quebec, Canada. Author (ESRO)

N70-37058# California Univ., Livermore. Lawrence Radiation Lab.

SPECTRAL COMPOSITION OF SEISMIC SOURCE FUNCTIONS ASSOCIATED WITH SOME REPRESENTATIVE NUCLEAR DETONATIONS

John E. Roberts 10 Nov. 1969 186 p refs Sponsored in part by AEC
(UCRL-50763) Avail: CFSTI

Fourier analyses of reduced displacement potentials and body-wave particle-displacement, particle-velocity, and particle-acceleration source functions are given for some representative nuclear detonations scaled to various yields. Possible consequences to the problems of analyzing distant detonations and predicting damage from nearby detonations are discussed. Author (NSA)

N70-37061*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

A METHOD FOR OBTAINING ANALYTICAL SOLUTIONS TO THE EQUATION FOR WIND-DRIVEN CIRCULATION IN A SHALLOW SEA OR LAKE

Marvin E. Goldstein, Willis H. Braun, and Richard T. Gedney Washington Sep. 1970 38 p refs
(NASA-TN-D-5989; E-5617) Avail: CFSTI CSCL 08H

A technique for obtaining solutions to a certain class of partial differential equations is introduced. This class of equations includes Welander's equation for the wind-driven circulation in shallow seas and lakes for a large class of bottom topographies. The technique, together with some results based on conformal mapping, is used to reduce the problems of finding solutions to Welander's equation for a closed body of water to the problem of solving an

ordinary differential equation. To illustrate the principles involved, the method is used to obtain the complete analytical solution for an elliptically shaped body of water with a particular choice of bottom topography when the depth is greater than one-half the Ekman friction depth. Author

N70-37077# Kiruna Geophysical Observatory (Sweden).
KIRUNA GEOPHYSICAL DATA: DATA SUMMARY 69/4–6, APRIL–JUNE 1969
L. Liszka, ed. [1970] 152 p Prepared jointly with European Space Sounding Rocket Range and UMEA Univ.
Avail: CFSTI

Data obtained at Kiruna (Sweden), April–June 1969, relating to geomagnetic variations and storms, earth currents, auroras, cosmic noise and ionospheric absorption are presented. ESRO

N70-37082# Geological Survey, Washington, D.C.
EARTHQUAKES
1969 20 p refs
Avail: Issuing Activity

A generalized history, the probable locations, and characteristics of earthquakes are briefly discussed. The measurement and prediction methods are presented. F.O.S.

N70-37084*# GCA Corp., Bedford, Mass. Technology Div.
RESEARCH DIRECTED TOWARD DEFINING THE VARIABILITY OF THE ATMOSPHERE BETWEEN 30 AND 200 KILOMETERS, PART 2 Final Report
E. D. Schultz Jul. 1970 93 p refs
(Contract NAS12-617)
(NASA-CR-112777; GCA-TR-70-6-N-Pt-2) Avail: CFSTI CSCL 04A

A continuing investigation over a number of years has been performed to gather atmospheric thermodynamic data for use in a study of the global variability of the structure of the atmosphere. The current program continued the data collection effort, resulting in the compilation of 400 additional rocket and optical probe soundings. A chronological listing of over 800 other soundings is presented. Discussion of computer programs that process and analyze this data and some of the Meteorological Rocket Network data are presented. Author

N70-37135# Commissariat a l'Energie Atomique, Bruyeres-le-Chatel (France).
UNDERGROUND NUCLEAR EXPLOSIONS: STUDY OF FRACTURED ZONES [EXPLOSIONS NUCLEAIRES SOUTERRAINES: ETUDE DES ZONES FRACTUREES]
Serge Derlich Feb. 1970 34 p refs In FRENCH; ENGLISH summary
(CEA-R-3941) Avail: CFSTI

Surveys after underground nuclear tests in the Sahara revealed several zones damaged by the shock wave and they were studied by examining bore-holes and the core samples. Seismic measurements showed that velocity changes were due to the opening up of natural fractures in the earth. It was possible to distinguish a crushed zone, a fractured zone, an internal damaged zone corresponding to the break-up of cores into discs, and an external damaged zone at increasing distances from the cavity. The methods used for examining these various zones made it possible to obtain useful information about their characteristics. Author (ESRO)

N70-37213# Weather Bureau, Salt Lake City, Utah.
TSUNAMI
Richard P. Augulis Feb. 1970 31 p refs
(PB-190157; ESSA-TM-WBTM-WR-48) Avail: CFSTI CSCL 08C

The tsunami is an ocean wave generated by seismic activity—eruption of volcanoes, slippage of faults, submarine landslides etc. The tsunami is usually unnoticeable in midocean, but when finally striking land its destruction can be considerable. The purpose is to acquaint personnel with some basic theoretical concepts and operational problems associated with the tsunami. Author (USGRDR)

N70-37289# Kiruna Geophysical Observatory (Sweden).
KIRUNA GEOPHYSICAL DATA: DATA SUMMARY 69/1–3, JANUARY–MARCH 1969
L. Liszka ed. [1970] 176 p Prepared jointly with European Space Sounding Rocket Range and UMEA Univ.
Avail: CFSTI

Data obtained at Kiruna (Sweden), January–March 1969, relating to geomagnetic variations and storms, earth currents, auroras, cosmic noise and ionospheric absorption are presented. ESRO

N70-37336# Central Intelligence Agency, Washington, D.C.
CARTOGRAPHIC AUTOMATIC MAPPING PROGRAM (CAM), DOCUMENTATION Final Report
4 May 1970 67 p refs
(PB-191779; CIA/BGI-CD-70-2) Avail: CFSTI CSCL 08B

The Cartographic Automatic Mapping program (CAM) was developed for use in automated small-scale cartography. The map location and scale may be varied and any of 16 basic map projections employed. Besides drawing linear features such as coastlines, CAM can generate grid lines, range rings, circles, ellipses, rectangles, azimuths, elevation rings, and symbols. The structure of the program is modular so that additional subroutines and data in different format can be easily added. CAM is written in Level H Fortran and designed to operate on IBM System 360 computers. Included is a data base of 8200 points describing world coastlines. Documentation includes projection equations, diagrams and references. USGRDR

N70-37339# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE MECHANISM OF INFRARED RADIATION OF THE UPPER ATMOSPHERE
B. F. Godiets et al 1970 15 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 8, no. 3, 1970 p 437–448
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

A theoretical analysis of the possible mechanisms of infrared radiation (thermal excitation, chemical reaction, electron excitation) is made for the model of a quiet atmosphere. The laminar configuration of infrared radiation is clarified, its physical reasons are examined. The great influence of electric fields on infrared radiation intensity is shown. Possibilities for amplifying radiation in the upper atmosphere are considered. Author

N70-37383*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
SPATIAL BIAS CORRECTION FOR SPORADIC METEORS PHOTOGRAPHED IN NEW MEXICO
Lynn U. Albers and George Diedrich Washington Sep. 1970 41 p refs
(NASA-TN-D-5711; E-5096) Avail: CFSTI CSCL 03B

The McCrosky and Posen data on Super-Schmidt sporadic meteors were studied for spatial bias. This bias is a function of meteor direction and velocity, camera location, and observing intervals. For each meteor, a number useful in correcting for spatial bias was computed. It is a measure of the likelihood of encountering a meteor with the same relative velocity vector during the 30-month span of photographing intervals. Author

N70-37382# Geological Survey, Washington, D.C. Topographic Div.

RESEARCH AND DEVELOPMENT Annual Report, Apr. 1970

Robert A. Huber, ed. Apr. 1970 62 p

(PB-192041; USGS-TD-70-003) Avail: CFSTI CSCL 08G

This annual report, covering the 12-month period ending in April 1970, summarizes the research and development activities of the U.S. Geological Survey, Topographic Division in the Office of Research and Technical Standards and in the Region offices at Arlington, Va., Rolla, Mo., Denver, Colo., and Menlo Park, Calif. The R and D projects mentioned concern the fields of cartography, field surveys, photogrammetry, and space technology. Author (USGRDR)

N70-37390*# Dartmouth Coll., Hanover, N.H. Thayer School of Engineering.

MAGNETOPAUSE STRUCTURE DURING THE MAGNETIC STORM OF 24 SEPTEMBER 1961

Bengt U. O. Sonnerup Jul. 1970 41 p refs Prepared in cooperation with New Hampshire Univ.

(Grants NGR-30-001-011; NGR-30-002-010)

(NASA-CR-112787) Avail: CFSTI CSCL 04A

An account is given of the Explorer 12 magnetic field observations of the magnetopause current layer on the inbound pass, which occurred during the main phase of a moderately strong magnetic storm. The accuracy of the Explorer 12 data reported was increased by use of an improved filtering procedure. Five magnetopause penetrations were observed in a time period of about 20 minutes; for each of these the data were used to calculate the vector normal to the current layer, the magnetic field component along that vector, and the polarization of the current layer. Normal magnetic field components significantly different from zero were obtained, and it is suggested that the observations during this pass in general are consistent with the so-called open magnetosphere model. Author

N70-37391*# Dartmouth Coll., Hanover, N.H. Radiophysics Lab.

ON THE EQUILIBRIUM OF THE MAGNETOPAUSE CURRENT LAYER

Shin-Yi Su and Bengt U. O. Sonnerup Jun. 1970 24 p refs

(Grant NGR-30-001-011)

(NASA-CR-112788) Avail: CFSTI CSCL 04A

Confinement of a uniform magnetic field by a warm hydrogen plasma with an average velocity parallel to the confined field is studied. It is found that for a given proton temperature equilibria exist whenever the electron temperature exceeds a certain critical value. Thus, at the magnetopause equilibrium states may exist near the nose of the magnetosphere but usually not along the tail. A comparison is made with the results of Parker and Lerche. The properties of the equilibrium solutions are discussed. Finally, the equilibrium confinement with the incident streaming plasma tangential to the magnetopause but perpendicular to the confined field is treated. It is concluded that in the geomagnetic equatorial plane magnetopause equilibria may occur on the afternoon side but not on the morning side of the magnetosphere. Author

N70-37406# California Univ., Berkeley. Earthquake Engineering Research Center.

SEISMIC RESPONSE OF SOIL DEPOSITS UNDERLAIN BY SLOPING ROCK BOUNDARIES

Houshang Dezfulian (Tehran Univ.) and H. Bolton Seed Aug. 1969 44 p refs

(PB-189114; EERC-69-9) Avail: CFSTI CSCL 08K

The finite element method of analysis provides a powerful analytical tool for analyzing the response of a soil deposit underlain by sloping rock boundaries. The mode superposition solution procedures does not, however, provide for the variability of the damping ratio associated with the different regions of a soil deposit. Procedures have been described which attempt to compensate for this shortcoming of the method by adjusting the response amplitudes determined by a finite element analysis. USGRDR

N70-37423*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

POSITION OF SUN AND MAGNETIC VECTOR FOR THREE LAUNCH SITES: WALLOPS ISLAND, WHITE SANDS, AND FORT CHURCHILL

George E. Kowalski and Lloyd T. Davis Jun. 1970 34 p refs

(NASA-TM-X-65315; X-721-70-238) Avail: CFSTI CSCL 03A

A series of graphs is presented whose purpose is to indicate the azimuth and elevation of the sun for any day in the year, for any time of day, at Wallops Island Range, the Churchill Research Range, or the White Sands Missile Range. An indication is also made of the azimuth and elevation of the geomagnetic vector at each of the launch sites. Instructions for use of the graphs, and a section explaining the origin and the computation of the coordinates for the graphs are included. Author

N70-37487# Coast Guard, Washington, D.C. Oceanographic Unit.

OCEANOGRAPHIC OBSERVATIONS, NORTH PACIFIC OCEAN STATION NOVEMBER, 30 DEG 00 MIN N., 140 DEG 00 MIN W.

David M. Husby Sep. 1969 222 p refs *Its* Oceanog. Rept. No. 26

(PB-189279; USCG-373-26) Avail: CFSTI CSCL 08J

The report contains the observed and interpolated temperature and salinity data plus the computed sigma-t, geopotential anomalies and sound velocities for 195 oceanographic stations occupied by U. S. Coast Guard Cutters at Ocean Station NOVEMBER (centered at 30 Deg N, 140 deg W) between 20 March 1967 and 31 Mar 1968. Daily casts of 13-14 Nansen bottles were made to a depth of 1500 meters when weather conditions permitted. In addition, sampling was successfully extended to near the bottom on at least one station during each patrol. Author (USGRDR)

N70-37488# Coast Guard, Washington, D.C. Oceanographic Unit.

OCEANOGRAPHIC OBSERVATIONS, NORTH PACIFIC OCEAN STATION VICTOR, OCTOBER 1966 – OCTOBER 1967. SEASONAL VARIATION OF OCEANOGRAPHIC CONDITIONS FROM OCEAN STATION VICTOR TO THE COAST OF JAPAN ALONG 34 DEGREES LATITUDE, JANURARY 1966 – OCTOBER 1967]

Joseph L. Shuhy and David M. Husby Sep. 1969 201 p refs *Its* Oceanog. Rept. No. 27

(PB-189280; USCG-373-27) Avail: CFSTI CSCL 08J

The report contains the observed and interpolated temperature and salinity data, plus the computed sigma-t geopotential anomalies and sound velocities for 110 oceanographic stations taken by four U. S. Coast Guard cutters during eight patrols at Ocean Station Victor (centered at 34 deg 00 min N, 164 deg 00 min E.) during October 1966 – October 1967 and for 50 stations taken by three U. S. Coast Guard cutters during four occupations of Standard Section P-I which runs from Ocean Station Victor to near the coast of Japan along 34 deg N. latitude. Author (USGRDR)

N70-37489# Coast Guard, Washington, D.C.

REPORT OF OCEANOGRAPHIC CRUISE USCGC NORTHWIND, NORTHERN BERING SEA-BERING STRAIT-CHUKCHI SEA

David M. Husby Jun. 1969 97 p refs *Its* Oceanog. Rept. No 24

(PB-189278; USCG-373-24) Avail: CFSTI CSCL 08J

The report contains the observed and interpolated temperature, salinity and dissolved oxygen data plus the computed sigma-t, geopotential anomalies and sound velocities for 83 oceanographic stations occupied by the USCGC NORTHWIND (WAGB 282) in the Bering and Chukchi Seas during 12-23 July 1967. Also included are the direct current observatios made at 66 of the oceanographic stations. Serial observations were made of temperature, salinity, oxygen and water flow at 5-meter intervals from the surface to near the bottom. Author (USGRDR)

N70-37486# Joint Publications Research Service, Washington, D.C.

TECTONIC ZONING OF AFGHANISTAN

V. I. Slavin et al 11 Aug. 1970 19 p refs Transl. into ENGLISH from Sov. Geol. (USSR), no. 4, 1969 p 68-81 Presented at the Colloq. on the Tectonics of Alpine Belt of the Near and Middle East, Baku, Apr. 1968

(JPRS-51143) Avail: CFSTI

Geological survey data were compiled to chart on a 1:500,000 scale the tectonic zones in an area of pre-Paleozoic and Upper Paleozoic substructures. The nature and structural age, time of geosynctinal down-warp initiation, formations, folding type and magnetism are taken into account in the zonal descriptions. A diagram is given with a break down of late Alpine foldings including: intrusions, axes of anticlines and synclines, tectonic dislocations, boundaries between mico- and eugeosynclinal parts of Bandi-Turkeystanskiy subsidence and tectonic zone boundaries. J.M.

N70-37501*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ION AND NEUTRAL COMPOSITION CHANGES IN THE THERMOSPHERIC REGION DURING MAGNETIC STORMS

S. Chandra and P. Stubbe (Max-Planck-Institut fur Aeronomie) Aug. 1970 26 p refs

(NASA-TM-X-65321; X-621-70-320) Avail: CFSTI CSCL 04A

The structural differences of the ion and neutral composition in the thermospheric region are studied by solving a system of basic ionospheric and atmospheric equations. The study shows that the compositional changes during a magnetic storm arise largely as a result of changes in the neutral composition at the turbopause. A decrease in [O]/[N2] in the lower atmosphere triggers a complex chain of events which results in an increase of the neutral gas temperature, depletion of the O(+) layer and enhancement of NO(+). The relative changes in these layers occasionally produce a sequence of electron density profiles giving rise to the so-called G condition. It is shown that, compared to the neutral atmosphere, the ionosphere is much more sensitive to the changes in [O]/[N2] in the lower thermospheric region. Since the ionospheric parameters can be measured much more accurately than the atmospheric parameters, it is argued that they should form an integral part of the observational data required to construct the atmospheric models. Author

N70-37591# Joint Publications Research Service, Washington, D.C.

GEOLOGICAL STRUCTURE OF THE SHEVA RIVER BASIN IN AFGANSKIY BADAKHSHAN (NORTHEAST AFGHANISTAN)

Yu. G. Leonov 12 Aug. 1970 6 p Transl. into ENGLISH from Sov. Geol. (USSR), no. 4, 1969 p 158-161

(JPRS-51155) Avail: CFSTI

A description of the deposits is presented, and the conditions of their occurrence by individual zones, each of which has a specific set of layers, are reviewed. The zones are separated by faults and the layers forming them occur in tectonic interrelationships. Author

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N70-36219# Aerojet-General Corp., El Monte, Calif. Geosciences Group.

RADIOMETRIC DETECTION OF OIL SLICKS Final Report, 14 Mar.-26 Oct. 1969

A. T. Edgerton and D. T. Trexler Jan. 1970 130 p refs

(Contract DOT-CG-93228-A)

(AD-702402; AGC-SD-1335-1) Avail: CFSTI CSCL 13/2

A study has been performed to assess the feasibility of using microwave radiometry for detection of oil pollution. The investigation stems from the U.S. Coast Guards requirement for an airborne surveillance system which can detect oil pollution during inclement weather and during the hours of darkness. Laboratory and airborne measurements were made of a variety of oil base pollutants. Laboratory investigations included microwave response as a function of oil film thickness, physical temperature of the oil-water system, pollutant type sensor wavelength, antenna polarization, and observation angle. These studies consisted of dual-polarization radiometric measurements (observational wavelengths of 0.8cm and 2.2cm) of Bunker C fuel oil, gasoline, and 20, 30, and 40 API gravity crude oil. The dielectric properties of these pollutants were also measured by means of a 0.81 cm ellipsometer. The results of the laboratory measurements were used to select the most suitable microwave radiometer for the airborne measurements. The airborne measurements were of small oil slicks on the open ocean off the Southern California Coast. Measurements were made from an aircraft instrumented with a dual-polarized 0.81 cm radiometer oriented with a forward antenna viewing angle of 45 deg from nadir. Pollutants examined during the tests include marine diesel fuel; 20, 30, and 40 API gravity crude oils; and a mixture of diesel fuel and 20-gravity oil. Measurements were made under various atmospheric and low sea state conditions, including several at night. Author (TAB)

N70-36224# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PHOTOTHERMOPLASTIC RECORDING OF INFORMATION

N. G. Nakhodkin et al 20 Feb. 1970 17 p refs Transl. into ENGLISH from Zh. Nauchn. i Prikl. Fotogr. i Kinematogr. (Moscow), v. 14, no. 1, 1968 p 41-48

(AD-703997; FTD-HT-23-612-69) Avail: CFSTI CSCL 11/9

The authors have discovered that optical images can be recorded on certain thermo plastic materials. Areas on a carrier illuminated by ultra violet light increase in size and can be developed by subsequent heating without charging the carrier. The advantages of this method include relative high resolution and the fact that wet development is not required. Author (TAB)

N70-36236# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

AERIAL SENSING AND PHOTOGRAPHIC STUDY OF THE EL VERDE RAIN FOREST, PUERTO RICO Final Report, Sep. 1964-Mar. 1967

Philip L. Johnson and David M. Atwood Dec. 1969 27 p refs

(AD-703123; CRREL-RR-250) Avail: CFSTI CSCL 2/6

Aerial and ground photographs were taken over a 2-year period of sites in the El Verde rain forest to record the consistency of the vegetational patterns in untreated sites and the changes that occurred following gamma irradiation. Four emulsions were used: panchromatic infrared, false color transparency and color

transparency. Densitometry was used to evaluate color film and the vegetation response to 3 months of radiation. The color emulsions provided the sharpest indication of damage to vegetation and the succession following treatment. Hemispherical photography of the canopy was evaluated in terms of a canopy cover index defined as per cent of light passing through the negative in a 90-degree cone area. Control stations were remarkably constant in all photography, establishing the stability and slow natural changes in rain forest structure. Spectral light measurements within the forest confirmed the predominance of far red shade light. Compared to similar studies on the chronic irradiated forest at Brookhaven National Laboratory the El Verde results were less distinct. Author (TAB)

N70-36371*# McDonnell-Douglas Co., Huntington Beach, Calif. Advanced Research Labs.

A STUDY ON RANGE GATED TEMPORAL REFERENCE ACOUSTICAL HOLOGRAPHY Final Technical Report

A. F. Metherell, S. Spinak, and J. Pisa 1 Jul. 1970 48 p refs (Contract NAS12-2166)

(NASA-CR-112412; MDC-Q0035) Avail: CFSTI CSCL 14E

The general medical imaging requirements for noninvasive visualization of soft tissue structures in man are examined. Selected imaging techniques, including both conventional pulse-echo imaging and various acoustical holographic imaging techniques, are then discussed, and acoustical holography is shown to exhibit distinct advantages. A double pulsed ruby laser method of optically recording a temporal reference acoustical hologram appears to be the most promising holographic imaging technique currently available. The primary conclusion is that acoustical holography, utilizing existing techniques, is generally feasible for the noninvasive visualization of soft tissue structures in man. Author

N70-36402# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SELECTION OF OPTIMUM CONDITIONS OF EXCITATION OF AN ELECTROLUMINESCENT MATRIX SCREEN DURING PHOTOGRAPHIC RECORDING OF INFORMATION TAKEN FROM A DIGITAL COMPUTER

V. M. Korsunskii 19 Dec. 1969 12 p refs Transl. into ENGLISH from Fiz.-Tekhnol. Vopr. Kibernetiki (USSR), no. 2, 1969 p 81–89

(AD-703159; FTD-MT-24-405-69) Avail: CFSTI CSCL 14/5

A line-by-line approach to electroluminescent screen displays is treated with emphasis placed on maintaining a uniform background luminosity. An image-back-ground brightness ratio of 3-4 permits the system to be used with a 1000-line image. Author (TAB)

N70-36422# Aerospace Corp., El Segundo, Calif. Lab. Operations.

AN INTRODUCTION TO FOURIER SPECTROSCOPY, REPORT FOR JUNE–OCTOBER 1969

Richard T. Hall 15 Jan. 1970 63 p refs (Contract F04701-69-C-0066)

(AD-704588; TR-0066(9260-01)-6; SAMSO-TR-70-147) Avail: CFSTI CSCL 3/2

Fourier spectroscopy is a technique discovered by Michelson in 1891 that recently began its renaissance with the advent of high-speed digital computers. Examples of results that were obtained with Fourier spectroscopic techniques to measure spectra of the planets in the near-infrared and spectra of gases in the far infrared are shown. The principles of Fourier spectroscopy are explained along with comments on practical techniques. A brief description of the computational techniques are given and a comparison of the advantages and disadvantages of Fourier spectroscopy versus conventional grating spectroscopy is made. The Aerospace Corporations far-infrared, lamellar-grating interferometer is described and some results obtained while using it are shown. The prospects for the future of Fourier spectroscopy are also discussed. Author (TAB)

N70-36496# Bendix Corp., Ann Arbor, Mich. Aerospace Systems Div.

ANALYSIS OF MULTISPECTRAL SCANNER DATA FOR LOCATION OF SAND AND GRAVEL DEPOSITS Final Report

David S. Hanson and David R. Morganstein Jan. 1970 95 p (Contract DAAK02-69-C-0705)

(AD-705673; BSR-2829) Avail: CFSTI CSCL 13/3

Data were collected with an 8-channel multispectral line scanner covering the UV, visible, and near IR. A test site near Lake Charles, Louisiana, was chosen as representative of river delta terrain in which the target materials, sand and gravel suitable for engineering construction, could be easily located for ground truth. Digital samples of tape recorded video were computer analyzed by a factor analysis program. The results of the analysis identified three basic terrain types, one of which is associated with the target materials, and permits automatic classification at real data rates to map extended areas of similar terrain. Author (TAB)

N70-36555# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).

EFFICIENCY OF A TELESCOPE WITH PLASTIC COUNTER AND LEAD CONVERTER FOR DETECTING PHOTONS [EFFICIENZA DI UN TELESCOPIO DI CONTATORI PLASTICI E CONVERTITO RI DI PIOMBO, PER LA RIVELAZIONE DI FOTONI]

G. Capon, M. A. Locci, G. P. Murtas, and G. Penso (Rome Univ.) 24 Mar. 1970 40 p refs In ITALIAN

(LNF-70/13) Avail: CFSTI

The experimental and theoretical efficiency of a high energy photon detector composed of plastic scintillators interspersed in layers of lead were studied in the reactions: positive electron + negative electron yielding gamma gamma, neutral pion + gamma, eta meson + gamma, which occur in the Adone storage rings. The experimental apparatus is described, and the results of applying the Monte Carlo method are discussed. Transl. by F.O.S.

N70-36586 National Lending Library for Science and Technology, Boston Spa (England).

ON THE DEVELOPMENT AND TESTING OF A HUMIDITY RADIOSONDE BASED ON THE PSYCHROMETRIC PRINCIPLE

J. Grziwa 24 Jun. 1970 23 p Transl. into ENGLISH from German report

(NLL-M-9219-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .2 NLL photocopy coupons

A new reference radiosonde for humidity measurements was developed and tested. The prototype was designed to provide more accuracy in height, weather forecasting, and temperature measurements for aviation meteorology. Experimental tests using the sonde in aerology shows satisfactory results, but indications are that a more effective radiation shield is needed for the wet measuring point and the blind time connected with the water-ice phase change. E.H.W.

N70-36618* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

APPARATUS HAVING COAXIAL CAPACITOR STRUCTURE FOR MEASURING FLUID DENSITY Patent

Eugene A. Atkisson, inventor (to NASA) Issued 30 Mar. 1965 (filed 19 Apr. 1961) 4 p Cl. 324-61

(NASA-Case-XLE-00143; US-Patent-3,176,222; US-Patent-Appl-SN-104187) Avail: US Patent Office CSCL 14B

A densitometer for compressible liquids, gases, or fluids in both liquid and gas phases is described. The device consists of an air dielectric capacitor made of several plates, whose capacitance is changed when immersed in a fluid. The indicator can be calibrated to read density directly, but must be calibrated separately for each fluid to be measured. N.E.N.

N70-36632*# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
OPERATION OF A THREE-FREQUENCY RIOMETER SYSTEM ON THE NASA 711 AIRCRAFT DURING THE 1969 AURORAL EXPEDITION
J. N. Bradbury 25 Jun. 1970 27 p
(Contract NASw-1966)
(NASA-CR-112356; LMSC/N-AP-70-1) Avail: CFSTI CSCL 04A

Riometric measurements are made of ionospheric absorption of cosmic noise in the D region, aboard the NASA 711 aircraft, during an auroral event. The instrumentation, modifications, and data acquisition procedures are described. A discussion of the new noise problems encountered, and the observed absorption events are described and correlated with all-sky camera, photometric, and satellite measurements. E.H.W.

N70-36676*# National Aeronautics and Space Administration, Washington, D.C.
OPTICAL TELESCOPE TECHNOLOGY
1970 795 p refs Workshop held at Huntsville, Ala., 29 Apr.–1 May 1969
(NASA-SP-233) Avail: CFSTI HC$10.00/MF$0.65 CSCL 17H

Optical telescope technology considered is used in the design and development of a 3-meter, diffraction-limited, spaceborne telescope. Emphasis is placed on improved gratings, lightweight optical mirrors, improved detectors, electronic imaging systems, and ultraviolet transport materials. For individual titles, see N70-36677 through N70-36758.

N70-36681*# Princeton Univ., N.J.
HIGH RESOLUTION MEASUREMENTS IN SPACE ASTRONOMY AND THE REQUIREMENTS FOR DIFFRACTION LIMITED OPTICS
Lyman Spitzer, Jr. *In* NASA, Washington Opt. Telescope Technol. 1970 p 33–38 (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 20F

Described are high resolution measurements and critical technological areas in the construction of large space telescopes. An advanced type of spectroscopic instrument with a 120-inch spaceborne telescope is planned for getting 0.1 A spectral resolutions on a star of 10th magnitude with an exposure of about one-half hour. Improvements in primary mirrors, positioning accuracy, imaging techniques, and gratings are projected as astronomical hardware goals. G.G.

N70-36682*# National Aeronautics and Space Administratinn, Washington, D.C.
TECHNOLOGY OBJECTIVES AND PLANS
Frank J. Sullivan *In its* Opt. Telescope Technol. 1970 p 39 (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 17H

Considered are problems in the state-of-the art associated with astronomy. This includes the construction of a 2- or 3-meter, monolithic, diffraction limited, primary mirror suitable for operation in space. G.G.

N70-36683*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE OAO SERIES OF SPACE TELESCOPES
Joseph Purcell *In its* Opt. Telescope Technol. 1970 p 41–54 (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 17H

A brief overview of the OAO program is given and the structure and supporting subsystems, of the flight telescope system for the OAO-2 are outlined. Discussed mission operations and observing capabilities require real time processing of telemetry and command data by computer. In the planning sequence, the astronomer defines the region of interest, and the support computer describes which potential targets are available. G.G.

N70-36684*# Boeing Co., Seattle, Wash.
ONE CONCEPT FOR A 3-METER CLASS SPACE TELESCOPE
David Bogdanoff *In* NASA, Washington Opt. Telescope Technol. 1970 p 55–64 (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 17H

Summarized is the concept for a 3-meter orbital telescope with an aperture of 120 inches. Interface problems between optical system geometry and structural design limit the size of the secondary mirror and its mounting structure to a 39.6 inch diameter with an obscuration ratio equal to 0.33. The length of the folded light paths that are handled within the cabin determine equipment arrangements and baseline configuration selection. The projected design is based upon geometry fixed by f/4 primary mirror optics and upon requirements of the structural and thermal arrangement. A launch configuration installed on top of the S4 stage of the Saturn 1B is shown in graphic form. G.G.

N70-36685*# Perkin-Elmer Corp., Norwalk, Conn.
OPTICAL MATERIALS AND PRIMARY MIRROR DESIGN
Roderic M. Scott *In* NASA , Washington Opt. Telescope Technol. 1970 p 65–67 (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 20F

Principle elements of large space telescopes are mirrors; they determine aperture components and provide most of the power for the system. Standards for large space telescopes require a primary mirror made from materials of low expansion coefficients, having a surface accuracy of 1/50 lambda rms at the wavelength of interest to be achieved at 2000 A. Proposed is the construction of a large mirror from a number of smaller sections where each portion can be moved and the whole array is similar to a complete monolithic mirror. G.G.

N70-36686*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
STRUCTURES FOR SPACEBORNE OPTICAL TELESCOPES
Erich E. Engler *In its* Opt. Telescope Technol. 1970 p 69–72 (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 17H

The ranking of design criteria for spaceborne optical telescopes is established in the following order: (1) alignment accuracy; (2) dynamic stability and behavior; (3) environmental influences; (4) reliability; (5) maintainability; (6) crew consideration; (7) payload integration; and (8) material selection. In all cases, the minimum thermal distortion to meet the pointing accuracy is the outstanding demand for the design engineer to satisfy. G.G.

N70-36688*# Massachusetts Univ., Amherst.
CONSIDERATIONS RELATING TO USE OF A LARGE ASTRONOMICAL TELESCOPE IN SPACE
John Strong *In* NASA, Washington Opt. Telescope Technol. 1970 p 83–87 (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 17H

Basic aspects that govern the full exploitation of astronomical telescopes in space are: (1) freedom from ultraviolet and infrared atmospheric absorption that limits spectral frequency bands, and (2) the absence in space of optical turbulence with atmospheric degradation of spatial resolving power. Extension into the far ultraviolet requires advanced polishing procedures and materials for mirror surfaces. Bowen's analysis is used to prove that limiting stellar blur circles of a 3-m diffraction limited telescope will be reduced six-fold by being in space. G.G.

N70-36689*# Rhode Island Univ., Kingston.
PHOTOELECTRONIC IMAGING DEVICES
Sol Nudelman *In* NASA, Washington Opt. Telescope Technol. 1970 p 89–102 refs (See N70-36676 20-14)

Avail: CFSTI HC$10.00/MF$0.65 CSCL 09A

Structural and functional aspects of various photoelectronic imaging devices are presented. Considered are: (1) electron beam scanning tubes; (2) electronic mechanisms in crystals as photoemissive and photoconductive sensors; (3) the silicon vidicon mosaic sensor; (4) photoemitters and their band structures; and (5) elementary photodetectors and their circuitry. G.G.

N70-36692*# National Aeronautics and Space Administration, Washington, D.C.
LENS DESIGN BY LARGE COMPUTERS
David S. Grey *In its* Opt. Telescope Technol. 1970 p 133–135 (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 20F

The lens designer uses computer optimization programs to finalize the merits of a lens configuration design as specified by input data. A lens optimization program compares two imperfect images, when the lens design goal is not a diffraction limited system so as to force a large fraction of the energy in the image of any object point into a small core image area. G.G.

N70-36693*# Arizona Univ., Tucson.
POSSIBILITIES FOR AUTOMATING OPTICAL MANUFACTURE
Robert R. Shannon *In* NASA, Washington Opt. Telescope Technol. 1970 p 137–139 (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 20F

The design and analysis of lenses by using large computers is considered. A lens design data sheet developed by the designer contains the analytic description of the surface. This formula is converted into a precise, usually symmetric, surface that not only matches the desired curve shape but also has a very high degree of smoothness. Operation of the lens design program depends on establishing the relationship between a set of variables and the aberrations to be controlled. The relationship is taken to be linear over some range, and a solution is obtained. Variables chosen must have convenient physical properties so that the designer no longer relates a single property of the aberrations to any single variable. G.G.

N70-36695*# Owens-Illinois Glass Co., Toledo, Ohio.
PROBLEMS IN ADAPTING SMALL MIRROR FABRICATION TECHNIQUES TO LARGE MIRRORS
Howard D. Hall *In* NASA, Washington Opt. Telescope Technol. 1970 p 149–152 (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 20F

Discussed are problems actually encountered in the manufacture of large mirrors with tools and techniques proven for smaller mirrors. Decrease in size of the allowable slope errors depends on techniques that suppress micro-ripple while allowing the mirror to be figured. The problem of compliance for large mirrors can be solved by a conservative support system; counterbalancing the polishing tool will prevent an increase in polishing pressure. G.G.

N70-36696*# Arizona Univ., Tucson.
SURFACE SMOOTHNESS OF LARGE ASTRONOMICAL MIRRORS: A COLLECTION OF FOUCAULTGRAMS
David A. Loomis *In* NASA, Washington Opt. Telescope Technol. 1970 p 153–164 (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 20F

Presented are a number of foucaultgrams with comments on various large astronomical mirrors. They are presented to stimulate problems in surface generation and smoothness and the prevention of roughness and warping. Also included are pictures of spherical mirrors that illustrate desirable surfaces of large aspheric mirrors. A technique for removing astigmatism and smoothing out the washband effect by repeated spinning and repolishing cycles with sub-sized tools is described. G.G.

N70-36699*# Battelle Memorial Inst., Columbus, Ohio.
THE EFFECTS OF PROCESSING ON THE DIMENSIONAL STABILITY OF BERYLLIUM MIRRORS
Robert E. Maringer *In* NASA, Washington Opt. Telescope Technol. 1970 p 181–188 refs (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 20F

The major causes of dimensional instability in beryllium mirrors are analyzed and identified in order to develop corrective measures. Residual stresses introduced by machining operations occasionally penetrate to depths greater than 0.010 inch causing considerable disruption of the surface layer and deformation twins below the surface layer. Chemical etching of all machined surfaces followed by stress-relief heat treatment is advocated to minimize the stress residue. A thermal cycling stabilization procedure between about -100 C to +100 C reduces intergranular stress in the beryllium crystal structure. Mirror fabrication from beryllium, prepared by either hot isostatic pressing or pressureless sintering methods, shows marked improvement over mirrors prepared by the hot pressing method. G.G.

N70-36705*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
DEGRADATION OF MIRROR SURFACES IN A PROTON ENVIRONMENT
E. L. Hoffman *In its* Opt. Telescope Technol. 1970 p 213–217 (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 20F

From reports of window contamination on spacecraft and the proton-induced contamination of the present study, it appears that contamination of mirror surfaces in space may be a more serious problem than proton degradation. Studies of both types of degradation should be continued. Any studies of contamination of mirror surfaces in a vacuum environment should include a radiation source because some types of contaminant films may not be deposited without irradiation. Investigation of proton effects on mirror surfaces requires that an ultra-clean vacuum system be used. This should include elimination of all elastomer seals as well as pumping systems using oils. Finally, a mirror-cleaning method has been developed that uses atomic oxygen; this cleaning method may have application to cleaning mirror surfaces in space. G.G.

N70-36706*# Owens-Illinois Glass Co., Toledo, Ohio.
THE DESIGN OF LIGHTWEIGHT CER-VIT MIRROR BLANKS
George A. Simmons *In* NASA, Washington Opt. Telescope Technol. 1970 p 219–239 (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 20F

Described is a technique for producing lightweight mirror blanks from Cer-Vit (glass ceramics material) that involves the machining of cavities into a solid blank. The blank is then acid-polished to remove any surface imperfections that might act as stress concentrators. A mathematical analysis for three specific mirror designs is performed and the results are given in calculated deflection profiles of lightweight mirrors. A preliminary design is presented for a 120-inch diameter lightweight mirror. G.G.

N70-36707*# Corning Glass Works, N.Y.
LIGHTWEIGHT MIRROR STRUCTURES
Eric Y. Loytty *In* NASA, Washington Opt. Telescope Technol. 1970 p 241–247 refs (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 20F

The combination of a new material with near-zero thermal expansion and the monolithic core technology allows lightweight mirror structures to be manufactured with weight savings approaching 80 percent of the equivalent solid. At the same time, this combination provides exceptional thermal and dimensional stability. Author

N70-36710*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MAIN MIRROR FOR A 3-MIRROR SPACEBORNE OPTICAL TELESCOPE
Wilhelm Angele *In its* Opt. Telescope Technol. 1970 p 281–282 (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 20F

The problems for orbiting telescope reflectors are many. High optical quality and light weight are the subject of this paper. The material selection for the reflector is of great importance. The weight-to-stiffness ratio should be a minimum. Form stability over a large temperature range is one of the basic requirements; the temperature expansion should be near zero. The material must be very uniform (homogeneous) and noncorrosive. Author

N70-36713*# Itek Corp., Lexington, Mass.
EVALUATION OF SURFACE FIGURE DURING MANUFACTURING
Jerrold Zimmerman *In* NASA, Washington Opt. Telescope Technol. 1970 p 291–296 refs (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 20F

Testing surface figures of optical components during manufacturing gives results that are useful to the optician and sufficiently accurate for the systems analyst. The most reliable technique is dual beam interferometry which produces direct, two-dimensional wavefront contours for mirror manufacturing control. G.G.

N70-36714*# Perkin-Elmer Corp., Norwalk, Conn.
FIGURE SENSING TECHNIQUES
Robert Crane, Jr. *In* NASA, Washington Opt. Telescope Technol. 1970 p 297–301 (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 20F

The application of two figure-sensing interferometers for testing large optics is described; the first is a scatterplate interferometer for testing the primary 36-inch fused silica mirror, and the second is a phase-measuring two-beam interferometer figure sensor in which the fringe pattern is analyzed electronically to permit real-time error sensing. The principal advantage of the phase-measuring interferometer is that data can be extracted in real-time for use in a control system. G.G.

N70-36717*# Keuffel and Esser Co., Hoboken, N.J.
HOLOGRAPHIC METHOD OF MONITORING THE PERFORMANCE OF LARGE TELESCOPE MIRROR
Kent E. Erickson *In* NASA, Washington Opt. Telescope Technol. 1970 p 311–314 ref (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 17H

A holographic method is utilized for direct monitoring of a large two-element orbiting telescope that uses starlight to exhibit the net effect, at the focal plane, of errors in figure, tilt, and focus of the primary mirror. The monitoring light imprints on the primary mirror a faint hologram produced by an object wave coming from infinity, and a reference wave coming from the focal plane. When illumintated by the reference wave, the hologram regenerates the object's wave and the telescope returns then this wave to the focal plane where it is monitored interferometrically. Simultaneous interferograms of the shape of the primary mirror and the shape of the diffracted wave are used for calibration. G.G.

N70-36718*# Massachusetts Inst. of Tech., Cambridge.
FIGURE CONTROL OF ACTIVE PRIMARY MIRRORS
Duncan Mac Kinnon *In* NASA, Washington Opt. Telescope Technol. 1970 p 315–320 refs (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 20F

Maximum resolving power of an orbiting telescope requires accurate maintainance of the primary mirror shape and prevention of surface perturbations that exceed accuracy limits of the diffraction limited performance. An active surface control system is illustrated that corrects mirror surface figure by comparing it to a desired reference surface by the figure sensor. Error data are evaluated by a figure-control-system computer that automatically commands the control actuator for action. A correct choice of algorithms for use with surface load actuators is of utmost importance. G.G.

N70-36719*# Perkin-Elmer Corp., Norwalk, Conn.
SOME OPTICAL SYSTEMS FOR A SPACEBORNE TELESCOPE
Abe Offner *In* NASA, Washington Opt. Telescope Technol. 1970 p 321–325 refs (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 17H

Examined are candidate optical systems for high resolution astronomical programs with a 3-meter aperture telescope that require a diffraction-limited guidance field of 3 arc minutes. Considered are a single spherical mirror with a detector at it's focus, a paraboloidal mirror with a detector, and a two-mirror optical system with Cassegrain and Gregorian arrangements. The short physical length and long equivalent focal length of the latter system can be sufficiently corrected so that over a 3 minute field the loss in the normalized relative energy due to aberrations is negligible. G.G.

N70-36720*# Itek Corp., Lexington, Mass.
FIELD CORRECTORS FOR REFELCTING TELESCOPES
Daniel H. Schulte *In* NASA, Washington Opt. Telescope Technol. 1970 p 327–334 refs (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSLC 17H

Various reflecting telescopes for spaceborne astronomy are described that have achieved large fields with one-, two-, and three-mirror systems. One mirror systems require a series of correcting lenses to cancel third order coma contribution of the primary, the partly balanced astigmatism, and higher order aberrations. Two aspheric mirrors are used to correct simultaneously spherical aberration and coma in aplanetic telescopes. If the instrument-package configuration does not lend itself to the use of self-correcting two-mirror systems, refracting field-correcting systems are used with arbitrarily selected two-mirror inputs, in general Cassegrains. Three mirror systems discussed contain a two-mirror corrector for an existing parabolic mirror that utilizes aspheric touchup on all three mirrors and departures from spacing relations to achieve balancing of aberrations so that fields of 2 degrees or more in diameter can be realized. G.G.

N70-36722*# Kollsman Instrument Corp., Syosset, N.Y.
STRUCTURAL DESIGN FOR LARGE SPACE TELESCOPES
Bailey W. Jackson *In* NASA, Washington Opt. Telescope Technol. 1970 p 351–357 (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 17H

Outlined are structural design concepts for earth-bound and space telescopes and their possible utilization in developing space telescopes of larger diameter and increased performance requirements. Described in detail is an optical assembly for the OAO telescope that has a f/5, 38-inch diameter, Ritchey Chretien form of Cassegrain, and is used as a collector for an Ebert-Fastie type of spectrometer. Its primary mirror is mounted on three bars; close control of tolerances for the tangent bars and their mountings insures proper alignment of the optical axis to the mechanical axis. The secondary mirror is mounted on the focus drive mechanism and is driven by focus-adjust commands from the ground station. G.G.

N70-36724*# Kitt Peak National Observatory, Tucson, Ariz.
GENERAL PHILOSOPHY OF MIRROR SUPPORT SYSTEMS
W. W. Baustian *In* NASA Opt. Telescope Technol. 1970

p 381–387 ref (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 20F

Mirror support systems for terrestrial telescopes, including the axial and radial supports, the defining units, a set of jacks for supporting the mirror when the axial supports are inoperative, and the cell on or in which the foregoing elements are mounted, are discussed. Design requirements are also considered for safety stops to provide seismic damping and to prevent the mirror from tipping forward if the telescope is accidently pointed below the horizon, for installation and removal of the mirror from the telescope and cell for re-aluminizing, and for provisions for washing the mirror. Author

N70-36734*# Beloit Coll., Wis.
THE REQUIREMENTS, DESIGN, AND MANUFACTURE OF OPTICAL FILTERS FOR ASTRONOMICAL SPACE TELESCOPES
Daniel J. Schroeder *In* NASA, Washington Opt. Telescope Technol. 1970 p 487–493 refs (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 17H

The current technology of optical filters suitable for space telescope applications and suggested directions for future development are considered. Emphasis is placed on the ultraviolet region down to 1000 A, with brief consideration of the far infrared. The various types of filters and their characteristics, and the availability of suitable materials are discussed. Only interference filters capable of providing a spectral resolution of 1 to 10 percent of the peak wavelength of the passband are considered. Author

N70-36736*# Weston Instruments, Inc., Newark, N.J.
IMAGE CONVERTERS AND IMAGE INTENSIFIERS
Martin Rome *In* NASA, Washington Opt. Telescope Technol. 1970 p 501–509 (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 09A

Tubes with radiant image outputs are considered and the properties of single- and multistage tubes, such as gain and resolution, and some of the tube elements are discussed. Single-stage image tubes are based on the proximity focus, the electrostatic inverter, and the magnetic image tube. Photocathodes are discussed in terms of spectral response and dark current. Author

N70-36737*# Westinghouse Electric Corp., Pittsburgh, Pa. Aerospace Div.
ELECTRONOGRAPHY
James A. Hall *In* NASA, Washington Opt. Telescope Technol. 1970 p 511–521 refs (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 14E

Research efforts to develop a large roll-film electronographic camera for aerial reconnaissance and astronomical observations are discussed. The studies show that such a camera is feasible and that photocathode life should be adequate for repeated missions with the recommended operating cycle. Author

N70-36738*# Westinghouse Electric Corp., Pittsburgh, Pa.
CAMERA TUBES EMPLOYING ELECTRON-IMAGING CHARGE-STORAGE TARGETS
G. W. Goetze *In* NASA, Washington Opt. Telescope Technol. 1970 p 523–570 refs (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 17B

The evolution of the secondary-electron-conduction (SEC) target, its operating characteristics, and SEC camera tubes are described in detail. The unusual attributes of the SEC camera, such as high gain, low lag, long storage, excellent integration capability, and point-source imaging characteristics, are described and related to a variety of uses. The use of the silicon diode array charge-storage target in the electron-imaging mode of operation is also discussed. Author

N70-36739*# Amperex Electronic Corp., Hicksville, N.Y.
THE PERFORMANCE AND CAPABILITIES OF RECENTLY DEVELOPED PLUMBICON TV CAMERA PICKUP TUBES
R. S. Levitt *In* NASA, Washington Opt. Telescope Technol. 1970 p 571–582 refs (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 17B

The operational features of the Plumbicon camera tube are discussed and the development of a flyback highlight-discharge electron gun is described. The Plumbicon in combination with the electron gun is especially applicable in the field of low-light-level television surveillance or in other applications where low contrast details and very bright, high contrast objects appear in the same scene. R.B.

N70-36740*# Radio Corp. of America, Moorestown, N.J.
NEW CAMERA TUBE DEVELOPMENTS
R. E. Simon *In* NASA, Washington Opt. Telescope Technol. 1970 p 583–589 refs (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 17B

The development of camera devices consisting of arrays of discrete elements are discussed with respect to semiconductor technology. The operational characteristics of the silicon-target vidicon tube and of thin film scanned arrays are described R.B.

N70-36741*# Radio Corp. of America, Moorestown, N.J.
THE IMAGE ISOCON AND RELATED DEVELOPMENTS FOR ASTRONOMICAL SPACE TELESCOPES
A. D. Cope *In* NASA, Washington Opt. Telescope Technol. 1970 p 591–597 (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 17B

The characteristics of the image isocon camera tube in performing various astrometric tasks are given. Further optimization of isocon tubes for one particular slow-scan camera system is discussed. A more ideal camera tube is proposed on the basis of the experimental results and projected performance. The main features of such a tube are discussed with respect to photosurface, storage targets, and readout. Author

N70-36742*# General Electric Co., Philadelphia, Pa.
RECENT DEVELOPMENTS IN IMAGE DEVICES
Kurt Schlesinger *In* NASA, Washington Opt. Telescope Technol. 1970 p 599–603 (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 09A

The development of an electrostatic image inverter, in which field flattening is achieved internally by electron-optical means, is described. The development of image intensifiers and camera tubes using unconventional approaches is also discussed. R.B.

N70-36743*# Michigan Univ., Ann Arbor.
INFRARED IMAGE RECORDING SYSTEMS
George J. Zissis *In* NASA, Washington Opt. Telescope Technol. 1970 p 605–613 refs (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 17E

The various types of infrared image recording systems and multispectral scanners are discussed on the basis of a literature survey. The recording systems are used for infrared sky surveys, planetary studies, and thermal maps of the moon. The operating modes of the different detector materials available are shown in tabular form. R.B.

N70-36747*# California Inst. of Tech., Pasadena.
GROUND-BASED ASTRONOMICAL OPTICAL DATA-HANDLING
Edwin W. Dennison *In* NASA, Washington Opt. Telescope Technol. 1970 p 657–659 (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 14E

The existing and planned ground-based astronomical instruments are discussed with respect to making them compatible with space astronomy. The techniques and observing concepts, as well as data handling, used in ground-based astronomy are studied for their possible application in designing instruments for a space station. R.B.

N70-36748*# Kitt Peak National Observatory, Tucson, Ariz.
SYSTEM ASPECTS OF THE KITT PEAK AUTOMATIC TELESCOPE
Peter R. Vokac and Frank E. Stuart *In* NASA, Washington Opt. Telescope Technol. 1970 p 661-672 (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 17H

The remotely controlled automated telescope is a computer-controlled system capable of automatically executing a predetermined program of astronomical observations, carrying out some on-line data reduction, and tabulating the results in suitable format. The optical-mechanical hardware, the electronic hardware, and the logic software operations are described. The system can also be operated manually, although automatic control is faster than manual control by an approximate factor of 10, because the computer has access to more information than the human operator. R.B.

N70-36749*# California Inst. of Tech., Pasadena.
CONSIDERATIONS OF DIGITAL IMAGE-PROCESSING
F. C. Billingsley *In* NASA, Washington Opt. Telescope Technol. 1970 p 673-692 refs (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 14E

The different kinds of image processing possible, some of the parameter boundaries and limitations, and some of the system techniques used are discussed. The broad area of image processing is divided into six applications areas with examples of the kinds of processing that may be applied in each. R.B.

N70-36757*# Johns Hopkins Univ., Baltimore, Md.
ABSOLUTE RADIOMETRY IN SPACE ASTRONOMY
William G. Fastie *In* NASA, Washington Opt. Telescope Technol. 1970 p 775-780 (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 20F

The requirements for absolute radiometric and spectrometric intensity measurements in the spectral range from 0.1 to 30 microns are considered. Precision radiometric measurements over long time intervals provide information about the distribution of planetary systems among the near stars, which is useful in planning experiments for interstellar spacecraft. Recommendations are made for improved standards and techniques for preflight and in-flight calibration of both manned and unmanned space telescopes. R.B.

N70-36801*# Columbia Union College, Takoma Park, Md. Dept. of Physics.
RELATIVE SPECTRAL RESPONSE OF PHOTODETECTORS, SUPPLEMENT 1
E. I. Mohr Aug. 1969 25 p refs
(Grant NGR-21-023-001)
(NASA-CR-112361) Avail: CFSTI CSCL 17H

The design and equipment set-up of a permanent installation for measuring the relative spectral response of photodetectors is reported. The instrumentation, calibration techniques, experimental procedures, and preliminary results are described. D.L.G.

N70-36807* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AIRPLANE TAKE-OFF PERFORMANCE INDICATOR Patent
Frederick J. Bailey, Jr., inventor (to NASA) Issued 9 Feb. 1965 (Filed 16 Sep. 1955) 7 p Cl. 73-178
(NASA-Case-XLA-00100; US-Patent-3,168,827; US Patent-Appl-SN-534901) Avail: US Patent Office CSCL 01D

An instrument is described for monitoring possible malfunctions during take-off by providing readings on excess thrust and resistance levels. The instrument is readily adjustable for different take-off weights and may be preset for altitude and temperature variations. An equation of motion for an aircraft during take-off is discussed. E.C.

N70-36808* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOLID STATE POWER MAPPING INSTRUMENT Patent
Robert Steinberg and William B. Schwab, inventors (to NASA) Issued 8 Dec. 1964 (Filed 28 Aug. 1961) 10 p Cl. 176-19
(NASA-Case-XLE-00301; US-Patent-3,160,567; US-Patent-Appl-SN-138540) Avail: US Patent Office CSCL 18D

A detecting and recording apparatus is described for mapping flux and power in nuclear reactors. Advantages of the apparatus include: closely spaced fuel plates, the capability for easy positioning and rapid mapping under water, minimal flux effects, fine spatial resolution, and instantaneous recording without the need for subsequent analysis of detecting elements. E.C.

N70-36824* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERODYNAMIC MEASURING DEVICE Patent
Virgil S. Ritchie and Howard F. Ogden, inventors (to NASA) Issued 23 Feb. 1965 (Filed 29 Jun. 1961) 7 p Cl. 73-212
(NASA-Case-XLA-00481; US-Patent-3,170,324; US-Patent-Appl-SN-120797) Avail: US Patent Office CSCL 14B

A cylindrical pressure sampling probe is described for sensing ambient static air pressures on high speed aircraft. Advantages of the probe include: operation over a wide Mach number range, insensitivity to altitude variations over a considerable range of angles of attack, and insensitivity to air stream alignment changes. J.M.

N70-36863# Weapons Research Establishment, Salisbury (Australia).
OPTICAL WAVEFRONT RECONSTRUCTION
R. G. Hughes Sep. 1969 24 p refs
(WRE-TN-OSD-108) Avail: CFSTI

Optical wavefront reconstruction is a two-stage process of photography used to record the three-dimensional character of an object. The theory to the two-stage process is first presented. The optical system actually used, divides light from a coherent source into two parts so that one part is scattered from an object and the other part, known as the reference beam, remains unaffected. These two wavefronts interfere to form a standing wave-pattern which is recorded on a photographic plate. The technique used in the first stage and the equipment developed for recording this pattern on a photographic plate are described. In the second stage of the process, the object is reconstructed from the recorded pattern by irradiating the plate with the reference beam. The character of the image reconstructed from the recorded pattern is discussed, and an example is included to illustrate the points mentioned. Author

N70-36877*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Space Sciences Div.
SPACE INSTRUMENTS
In its Space Programs Sum. No. 37-62, Vol. 3, 30 Apr. 1970 p 9-14 ref (See N70-36876 20-34)
Copyright. Avail: CFSTI CSCL 20F

A functional description is given of the gamma ray spectrometer with an NaI(Tl) scintillation crystal for Apollo 16. The components, electronics, and operation are included. Description

is also given of the polarizers and retardance plates for a vector helium magnetometer. Means of obtaining optimal circular polarization by controlling retardance plate rotation or polarizer film transmission are described. It is concluded that H-film made of polyvinly alcohol plus iodine will not be satisfactory, but rotating the retardance plate about its axes gives an effective and accurate circular polarizer. N.E.N.

N70-36878*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Space Sciences Div.

SCIENCE DATA ANALYSIS

In its Space Programs Sum. No. 37-62, Vol. 3 30 Apr. 1970 p 15-25 refs (See N70-36876 20-34)

Copyright. Avail: CFSTI CSCL 14B

Testing of the scientific payload of a lunar rover, digital removal of noise from video imagery, and Polaroid quick-look system are described. Tests were made on the TV camera, surface sampler, auger system, and chipper and tongs device for the lunar rover. It is felt that with the use of the test methods, problems associated with the instruments and operating procedures were identified. Computer techniques are described which remove periodic, long term, and spike noises from images, and their application to a Mariner Mars 1969 photograph is given. The Polaroid quick-look system interfaces directly with an IBM 360 computer and provides a 3.5 x 4.5 inch photograph in approximately 1.5 min. The design and hardware implementation are outlined. N.E.N.

N70-36903*# Michigan Univ., Ann Arbor. Dept. of Electrical Engineering.

LABORATORY DEVELOPMENT OF A SATELLITE EXPERIMENT FOR GAS SURFACE INTERACTION STUDIES Final Report

J. C. Zorn, G. R. Carignan, J. C. Pearl, Denis P. Donnelly, and J. R. Caldwell Jan. 1970 104 p refs

(Contract NAS8-21450)

(NASA-CR-61320) Avail: CFSTI CSCL 14J

The objective of this study has been to develop a technique and associated flight hardware for measuring the velocity distribution of molecules in a rarefied gas; the resulting experiment package is to be used for the measurements of gas-surface interaction phenomena in situ in the earth's atmosphere. The metastable time-of-flight system described in this report has been prepared to achieve this objective. Specifically, it has been demonstrated that: (1) the velocity distributions of metastable atoms produced by electron impact can be measured with a time-of-flight analyzer; and (2) these distributions can be related to the incident gas flux through kinematic considerations. In addition, breadboard electronics for data analysis in flight experiments has been successfully tested in the laboratory. Author

N70-36905# Weapons Research Establishment, Salisbury (Australia).

WRE EXPERIMENTAL LONG FRAME INSTRUMENTATION CAMERA

R. P. Bonnell Jun. 1969 15 p

(WRE-TN-PD-101) Avail: CFSTI

A description is given of the preliminary development work on an experimental intermittent camera mechanism providing a 5-1/4 in. pull down and capable of operating at 40 frame/s and possibly at higher speeds. Author

N70-36907* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

MECHANICAL COORDINATE CONVERTER Patent

Richard M. Beckwith, inventor (to NASA) Issued 5 Jan. 1965 (filed 26 Dec. 1962) 6 p Cl. 33-1 Sponsored by NASA

(NASA-Case-XNP-00614; US-Patent-3,163,935; US-Patent-Appl-SN-247419) Avail: US Patent Office CSCL 14B

An apparatus is described which is designed to be used in conjunction with tracking antennas for spacecraft or satellites which may be oriented in either the azimuth-elevation coordinate system or hour angle-declination coordinate system. The apparatus is intended to illustrate graphically the relation between the two different coordinate systems. Another purpose of the converter is to supplement electronic digital converters. The mechanical coordinate converter is operated in the following manner: With the polar and declination angles known, a declination gimbal and polar gimbal are adjusted so that a declination scale disk and polar scale cylinder indicate the known angles. The azimuth dial scale and elevation scale cylinder then indicate the corresponding azimuth and elevation angles. Conversely, the polar and declination angles may be determined by adjusting the gimbals connected with the azimuth dial scale and radar antenna simulator to indicate known azimuth and elevation angles. P.A.B.

N70-36981*# Syracuse Univ. Research Corp., N.Y.

GENERAL AVIATION WEATHER AVOIDANCE SENSOR STUDY

George M. Kirkpatrick Jun. 1970 227 p refs

(Contract NAS12-2032)

(NASA-CR-112774) Avail: CFSTI CSCL 01D

The report includes: (1) definition of the operational characteristics of on-board weather detection systems, (2) alternative techniques for single and dual in-line engine aircraft, (3) a survey of new system technology, particularly components for electronic scanning, and (4) several proposed system block diagrams with performance specifications and rough estimates on development and quantity production costs. A sketch of a proposed antenna configuration for a low-cost weather radar with an engine-driven scanner is shown. Laboratory measurements on the proposed antenna configuration are recommended for the first phase of a development program. Author

N70-36991# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.

DUAL-CHANNEL LOG COUNT RATE METER

William J. Woodward Mar. 1970 13 p refs

(Contract AT(07-2)-1)

(DP-1202) Avail: CFSTI

An instrument was developed to monitor two locations for radioactivity. Each monitoring channel contains four plug-in circuit boards connected to form a count rate meter with a four-decade logarithmic readout. Scintillation detectors are used. Author (NSA)

N70-37025# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

FLIGHT-TESTING THE HIGH-SENSITIVITY ONERA ACCELEROMETER

Michel Delattre and Jacques Bouttes 1970 13 p refs Presented at the 8th Intern. Symp. on Aerospace Instr., Cranfield, Gt. Brit., 23-26 Mar. 1970 Submitted for publication

(ONERA-TP-794) Avail: CFSTI

The CACTUS accelerometer was flight tested for the first time on a sounding rocket launched from the French Guiana Space Centre in November 1969 (Operation Athalie). It was mounted in a sphere that separated from the main payload after being stabilized. The three components of the deceleration due to the sphere drag were measured with a design sensitivity of 10 to the minus 8th power/sec/sec, thus qualifying the accelerometer for fine three-axis space measurements. Author (ESRO)

N70-37039# General Electric Co., Cincinnati, Ohio. Nuclear Systems Programs

LIFE TESTING SMALL DIAMETER THERMOCOUPLES AS A FUNCTION OF THERMAL CYCLING

W. G. Baxter, D. E. Conner, and W. Rauch Nov. 1969 58 p refs
(Contract AT(40-1)-2847)
(GEMP-737) Avail: CFSTI

An air atmosphere electrically heated furnace for 1200 F operation was designed for thermal cycling (1200 – 600 F) by means of steam injection. This unit has operated in excess of 3600 cycles during four test periods and has clearly demonstrated the superior performance of certain commercially available small diameter (0.0625 in OD), MgO insulated, stainless steel sheathed thermocouples under the specific thermal cycling conditions experienced. Exceptional thermal cycling stability was experienced with the small diameter, MgO insulated, stainless steel sheathed Copper-Constant thermocouples. No thermocouple in this system failed in testing. Also, Chromel – Alumel thermocouples were tested. Recommendations for further testing these thermocouples for the LMFBR program are given. NSA

N70-37043*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
REMOTE VISUAL INSPECTION SYSTEM
J. E. De Castra 27 Jul. 1970 20 p
(NASA-TM-X-64552) Avail: CFSTI CSCL 14B

A visual inspection system and techniques for inspecting areas not accessible for direct viewing, such as the inside of valves and lines installed on a flight vehicle were developed. The phases of research included mirror systems, rigid borescopes, flexible fiberscopes, closed circuit television, and light supplies. The project produced an operational television-fiberscope inspection system which is available with an operator for on-call service. The system is mounted in modular sections on a standard laboratory cart, weighs only 220 pounds, operates on 110 volts, and can be moved in a car or light truck by one or two people. Author

N70-37045*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
INVESTIGATION OF AN OPTIMUM DETECTION SCHEME FOR A STAR-FIELD MAPPING SYSTEM
Melvin D. Aldridge and Leonard Credeur Washington Sep. 1970 33 p refs
(NASA-TN-D-5972; L-6477) Avail: CFSTI CSCL 03B

An investigation was made to determine the optimum detection scheme for a star field mapping system that uses coded detection resulting from starlight shining through specially arranged multiple slits of a reticle. The computer solution of equations derived from a theoretical model showed that the greatest probability of detection for a given star and background intensity occurred with the use of a single transparent slit. However, use of multiple slits improved the system's ability to reject the detection of undesirable lower intensity stars, but only by decreasing the probability of detection for lower intensity stars to be mapped. Also, it was found that the coding arrangement affected the root mean square star position error and that detection is possible with error in the system's detected spin rate, though at a reduced probability. Author

N70-37050*# Arizona Univ., Tucson. Steward Observatory.
TEMPERATURE EFFECTS ON PHOTOGRAPHIC SENSITIVITY
Dennis R. Hollars Jul. 1970 68 p refs
(Grant NGR-03-002-032)
(NASA-CR-112768; T-70-17) Avail: CFSTI CSCL 14E

The effect of temperature on the photographic sensitivity of three emulsions was investigated over the restricted platen temperature range of approximately 16 C to – 55 C. Exposures on Tri-X and Plus-X were made in neutral, red (6050Å), and blue (4490Å) light. The exposures on 103a-O were made only in neutral and blue light due to the insensitivity of 103a-O to light redder than about 5500Å. In each exposure a 12-step neutral density wedge was imaged on the film. The results are straightforward. Each emulsion displayed a sensitivity dependence with temperature in each color. The Tri-X and Plus-X showed points of optimum temperature (at maximum density) within the range employed. The optimum temperature (at maximum density) within the range employed. The optimum temperature however was not constant but varied with emulsion, color, and light level. The optimum temperature in general increased with increasing light level and was apparently higher at all light levels for the red exposures than for the blue. The 103a-O displayed a nearly linear decrease in sensitivity with decreasing temperature. The point of optimum temperature for the 103a-O is therefore higher than 16 C at these light levels. Author

N70-37072# Aeronautical Research Council (Gt. Brit.).
A SHORT STATIC PROBE WITH GOOD INCIDENCE CHARACTERISTICS AT SUPERSONIC SPEED
I. S. Donaldson and D. J. Richardson (Brit. Aircraft Corp.) 1970 20 p refs Supersedes ARC-29558
(ARC-CP-1099; ARC-29558) Copyright. Avail: CFSTI; HMSO 5s; BIS $1.10

Tests carried out on a short static probe at supersonic speeds between Mach numbers of 1.1 and 2.5 are described. The probe consists of a 50 deg included angle cone-cylinder having sensing holes 0.88 calibres aft of the cone-cylinder junction. The tests show that at zero incidence the probe measures a pressure (approximately independent of Mach number) of 0.793 times the local static pressure. They also show that, at up to 18 deg incidence in any pitch plane, the pressure measured is 0.763 + or – 0.03 times the local static pressure. For a limited Mach number range near a Mach number of 1.6, this accuracy can be maintained to incidences over 30 deg. Relatively small internal differences between externally identical probes appear to have a significant effect on the incidence characteristics and in some respects can improve the performance. Author (ESRO)

N70-37110# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
CRYOSTAT CALIBRATION BENCH, BETWEEN 1.2 AND 5.2 K [BANC D'ETALONNAGE DE CRYOSTANCES ENTRE 1,2 ET 5,2 K]
Guy Hanuise and Henri Morand 1970 8 p refs In FRENCH Presented at the Colloq. on Helium, Grenoble, France, 23 – 25 Mar. 1970 Submitted for publication
(ONERA-TP-810) Avail: CFSTI

The resistor to be calibrated is immersed in a cryostat where He-3 or He-4, according to the temperature range, is maintained at a constant temperature by balancing its pressure with a vacuum pump. An accuracy of 0.001 K has been obtained with a time constant of 0.0001 K/sec. Author (ESRO)

N70-37124# Argonne National Lab., Ill.
WORKING EXPERIENCE WITH HIGH-TEMPERATURE STRAIN GAGES
A. H. Marchertas, C. Fiala, and S. H. Fistedis Dec. 1969 39 p refs
(Contract W-31-109-eng-38)
(ANL-7648) Avail: CFSTI

Experience obtained with the Baldwin – Lima – Hamilton (BLH) Type FNWFB9 – 50 – 12 fullbridge, weldable, high-temperature strain gage is described. Circumstances leading to the investigation and reasons for failing to meet its original objectives are described. Shortcomings of this gage type, which are similar to those of other high-temperature gages, are discussed for the benefit of users of high-temperature gages. Testing of the gages at the FARET fuel assembly test loop is discussed. Author (NSA)

N70-37158*# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.
DISPLAY INSTRUMENTATION FOR V/STOL AIRCRAFT IN LANDING
Noel A. J. Van Houtte (Ph.D. Thesis) Jun. 1970 155 p refs
(Grant NGL-22-009-025)
(NASA-CR-112779; MVT-70-2) Avail: CFSTI CSCL 01D

A V/STOL aircraft (of the tilt-engine type) was simulated and flown from cruise altitude to touchdown with severe wind disturbances, descending along glideslopes of 4.47 deg, 8.87 deg, and 17.3 deg. A general display program was written to display a skeleton scenery, consisting of lines connecting the runway boundaries, the glideslope lines, and several distance indicating poles. The piloting task consisted of staying in level flight until intercept of the glideslope, then in tracking the glideslope to hover, and in landing the aircraft with minimum impact velocity and maximum accuracy. The task was quite difficult, because of the lack of stability augmentation. The value of the perspective glideslope is shown in the ease of performing coordinated maneuvers, the consistency of touchdowns, accuracy of tracking the glideslope, the learning curve, and the effectiveness of the representation of the integrated real world outside picture. Author

N70-37171# Signals Research and Development Establishment, Christchurch (England).
F/1 LOW RESOLUTION MONOCHROMATOR
J. S. S. Whiting and J. M. Williams Jul. 1969 7 p
(SRDE-69037) Avail: CFSTI

The construction and performance of a wide aperture low resolution monochromator are described. The instrument provides an alternative to sets of interference filters for optical pumping experiments. Author (ESRO)

N70-37207# Commissariat a l'Energie Atomique, Bruyeres-le-Chatel (France).
AUTOMATIC ELUTION APPARATUS: PLUTONIUM ANALYSIS APPLICATION [APPAREILLAGE D'ELUTION AUTOMATIQUE: APPLICATION AU DOSAGE DU PLUTONIUM]
Michele Kunzle-Lutz and Henri Metivier Mar. 1970 24 p refs In FRENCH; ENGLISH summary
(CEA-R-3922) Avail: CFSTI

The analytical procedures for the anionic exchange of plutonium are surveyed and an apparatus for automatic exchange sequence analysis is described. It has ten independent analytical sequences which are controlled by the analysis itself. Author (ESRO)

N70-37338# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Materials Science Branch.
ELECTRON CHANNELLING PATTERNS IN SCANNING ELECTRON MICROSCOPY. 1: THE GENERATION OF PATTERNS IN THE JSM-2 SCANNING ELECTRON MICROSCOPE
E. M. Schulson May 1970 31 p refs
(AECL-3654) Avail: CFSTI; Atomic Energy of Can., Ltd., Chalk River: $1.00

Based on the requirements of high beam current and small beam divergence at the crystal surface, three methods are described and experimental results given for generating electron channelling patterns in the JSM-2 scanning electron microscope. In the first method, lens 2 is turned off and lens 1 is operated at minimum setting or is turned off, giving a beam current of 10 to the minus 7th power amps and a divergence of 0.0003 radians. The beam size, however, is large and is not suited for topographical examinations. The second method overcomes this difficulty and provides a narrow channelling beam. In this case, lens 1 is operated at extra long focal lengths by removing the pole-piece and lens 2 is set to focus the beam on the specimen to a probe diameter of 1 to 10 micrometers; the criterion of divergence is satisfied by reducing the size of the aperture in lens 1. The third method describes a wide collimated beam capable of integrating out of the image all contrast arising from variations in surface features, leaving only channelling contrast. In this case, the second method is modified by increasing the setting of the first lens and adjusting lens 2 so that its focal length equals its object distance. Author

N70-37368# Tokyo Univ. (Japan). Inst. for Nuclear Research.
WIDE-SCREEN TYPE MEASURING PROJECTOR
T. Kitagaki, S. Tanaka, T. Sato, H. Ichimura, H. Kichimi et al Dec. 1969 31 p In JAPANESE
(SJC-T-69-3) Avail: AEC Depository Libraries

Similarly to its predecessor, the MP-2 utilizes a film plane digitizing system for the digitization in particle track measurement. The MP is a bubble-chamber measuring projector. A film adsorbed on the film station is projected onto the screen. The film station is moved in the X- and Y-direction; and the coordinate, after adjusting the measuring point to the cross hair line, is read out as the movement of the film station. The points of improvement in the MP-2 are increased automatization, enlargement, and rapid operation. Construction and mechanism of the MP-2 are described. Various check measurements and the results of measurements of events are presented. Author (NSA)

N70-37376# Bureau of Radiological Health, Rockville, Md. Div. of Electronic Products.
A COMPARISON OF MICROWAVE DETECTION INSTRUMENTS
Robert L. Moore, Stephen W. Smith, Robert L. Cloke, and David G. Brown Apr. 1970 17 p refs
(PB-191395; BRH/DEP-70-7) Avail: CFSTI CSCL 14B

Microwave power density instrumentation can be classified according to intended use, the type of detection system employed, and the type of information displayed. The intended use is subdivided into desirable features for laboratory instruments and survey instruments; method of detection is broken into thermal and electrical detection; and the information display category is divided into quantitative and qualitative display. Several commercial microwave power density meters which have been tested by the Division of Electronic Products, Bureau of Radiological Health, are compared according to the following criteria: accuracy, sensitivity, dynamic range, reliability, ease of measurement, thermal stability, battery life, and cost. Author (USGRDR)

N70-37430# Los Alamos Scientific Lab., N. Mex.
IMPROVING GRID IONIZATION CHAMBER CHARACTERISTICS FOR ALPHA SPECTROMETRY
Rene Le Du et al 3 Apr. 1970 12 p refs Transl. into ENGLISH from French report CEA-R-3566, 1968 Sponsored by AEC
Prepared by Kanner Associates
(LA-4243-tr; CEA-R-3566) Avail: CFSTI

The rise time of the signals obtained with a grid ionization chamber depends on the orientation in the chamber and on the mobility of the ionization components. Grid chambers are fitted with an electronic system which analyses the signals due to the electronic ionization components which are collected on the plate and on the source holder. By obtaining coincidence between these two signals, it is possible to select paths of any given orientation. Using this principle an electronic collimator was built which does not have the disadvantages of a mechanical collimator for alpha spectra studies, and which, further, considerably reduces the background of the chamber. Simultaneously with the study of the improvement of alpha spectra with the device, it was found possible to dissociate the contributions of back-diffusion and of self-absorption phenomena to the activity of an alpha source. Some results are presented. Author (NSA)

N70-37450# Eppley Lab., Inc., Newport, R.I.
REPORT ON THE EVALUATION OF THE NESC BLACKBODIES EMPLOYED IN THE SIRS INVERSE ATMOSPHERIC TEMPERATURE SOUNDING EXPERIMENTS
Final Technical Report
31 Mar. 1970 31 p
(Contract ESSA E-66-70(N))
(PB-191793) Avail: CFSTI CSCL 04B

The report discusses the comparison of the NESC radiation test sources used in the calibration of the SIRS and SCR instruments, to be flown on the Nimbus D satellite, with the IPS (Newport), NPL (London) and NRC (Ottawa) radiation references. The purpose of these comparisons was to establish instrument calibration in terms of such available radiation standards, in order that the eventual satellite measurements can be interpreted in terms of any future radiation measurement scales and standards. Author (USGRDR)

N70-37472*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
COORDINATE SYSTEMS IN RELATIVISTIC FREQUENCY SHIFTS OF ATOMIC CLOCKS
Fred D. Wills 16 Sep. 1969 29 p refs
(NASA-TM-X-53934; MSFC-IN-SSL-N-67-14) Avail: CFSTI CSCL 14B

The theoretical possibility of eliminating the effects of Doppler, special relativity, and electromagnetic propagation through the atmosphere in making measurements of frequency shifts of two identical atomic oscillators is described. One of the oscillators is considered to be located on the surface of the earth and the other one in synchronous orbit almost directly above the earth-based oscillator. The frequency shifts measured will then arise principally from the pure gravitational field of the earth and a rotational effect due to making the measurements in a uniformly rotating coordinate system. The technique is referred to as a double Doppler elimination procedure. Author

N70-37474*# Techtran Corp., Glen Burnie, Md.
A QUADRUPOLE MASS FILTER [ZUM QUADRUPOL-MASSENFILTER]
G. Otto Washington NASA Sep. 1970 12 p refs Transl. into ENGLISH from Proc. of the Symp. on Electron and Vacuum Phys., Hungary, 1962 (Budapest), 1963 p 429–438
(Contract NASw-2037)
(NASA-TT-F-13203) Avail: CFSTI CSCL 14B

The stable solutions of the equations of motion for charge carriers in a quadrupole mass filter are given. The calculated maximum oscillation amplitudes are represented graphically for different resolving powers with variation of the phase of the HF-field on the entrance, origin, and the radial initial velocity of the ions. Author

N70-37483# Illinois State Water Survey, Urbana.
INVESTIGATIONS OF CROP-HAIL LOSS MEASUREMENT TECHNIQUES
N. A. Barron, S. A. Changnon, Jr., and J. Hornaday 31 Jan. 1970 70 p refs Prepared for Crop Hail Insurance Actuarial Assoc., Chicago
(PB-189706; RR-42) Avail: CFSTI CSCL 02C

An exhaustive study of crop losses from a damaging hailstorm was pursued using: (1) detailed post-storm field measurements of loss as determined from standard adjusting techniques; (2) post-storm aerial photographs taken on different days using infrared color and standard color films; and (3) actual yield data from the damaged fields. The measurements of loss from the in-field adjustments at various sampling densities and from the film data were compared with each other and against the final losses reflected in the harvested yields. Film data taken over corn plots where various treatments to simulate hail damages were applied were also studied in a similar fashion. The primary aim of the project was to ascertain whether aerial infrared color photographs could provide objective and quantitative measures of crop-hail loss. Author (USGRDR)

N70-37495*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
MONITORING AIRBORNE PARTICULATE CONTAMINATION
T. W. Lewis 12 Sep. 1969 55 p
(NASA-TM-X-53881; MSFC-R-ME-IN-67-1) Avail: CFSTI CSCL 14B

The test program to determine the accuracy of the instrumentation and to establish an operational coefficient of correction for the valve clinic electronic particle monitoring system is described. Author

N70-37506*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
PHYSICS OF THE CLOCK EXPERIMENT
Russel D. Shelton, Nat Edmonson, Jr., and Fred D. Wills 16 Sep. 1969 10 p
(NASA-TM-X-53932; MSFS-R-SSL-INN-67-12) Avail: CFSTI CSCL 14B

A simple treatment of the relativistic clock experiment is given in terms of observed frequency shifts of a standard oscillator or clock. No attempt is made to introduce the details of atmospheric disturbances, measurement errors, or electronic changes in the basic clock frequency to provide for more convenient transmission, reception, or signal comparisons. Author

N70-37515# Commissariat a l'Energie Atomique, Cadarache (France). Centre d'Etudes Nucleaires.
CALIBRATION METHOD OF A NaI(Tl) DETECTOR. APPLICATION TO GAMMA EMITTER DOSIMETRY IN GASEOUS PHASE [METHODE D'ETALONNAGE D'UN DETECTEUR NA I(TI). APPLICATION AU DOSAGE D'EMETTEURS GAMMA EN PHASE GAZEUSE]
Roger Berne and Jean Deriot Jan. 1970 45 p refs In FRENCH
(CEA-N-1261) Avail: AEC Depository Libraries

A general method for calculating the absolute total efficiency of a cylindrical NaI crystal is given for various geometries including a point source, line source, disk source, and cylindrical source. The photofraction of this crystal is determined experimentally. The product of the absolute total efficiency and the photofraction gives the absolute peak efficiency R of the crystal for those geometries. A graph of the variation of R with E gamma (energy of the incident photon on the crystal) is presented. These curves are generally used to determine the quantity of radionuclides contained in a source of a given geometry when the corresponding reference source is unknown. Cylindrical gaseous sources are used, but reference sources are practically impossible to find. (NSA)

N70-37526*# Translation Consultants, Ltd., Arlington, Va.
CONTACTLESS MEASUREMENT OF THE TIP CLEARANCE IN A JET TURBINE ENGINE [BEZSTYKOWY POMIAR LUZU WIERZCHOLKOWEGO W TURBINIE SILNIKA ODRZUTOWEGO]
J. Lewitowicz et al Washington NASA Sep. 1970 8 p Transl. into ENGLISH from Polish Conf. Proc. p 151–153 2D Sci. and Tech. Conf. on Meas. of Dyn. Mech. Quantities Held in Warsaw, 29 May–1 Jun. 1968
(Contract NASw-2038)
(NASA-TT-F-13178) Avail: CFSTI CSCL 14B

The method is based on the characteristics of radioactive isotopes, and it permits the determination of tip clearance while the jet engine is operating. This makes it possible to observe changes in clearance width during various periods of time, e.g.

during intervals between overhauls. The method described can also be used to measure the radial clearance between an arbitrary element and its housing. Author

N70-37558*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AN ANALYSIS OF CASSEGRAIN OPTICS
Joe Michlovic 16 Sep. 1969 16 p ref
(NASA-TM-X-53935; MSFC-IN-SSL-T-67-16) Avail: CFSTI CSCL 17H

Equations relating to the properties and behavior of a Cassegrain optical system are presented. The effective focal ratio of the system, the movement of the focal plane in using the system with a radiometer, and plate scale and effective focal length are discussed mathematically. It is stated that the assumption that the effective focal length is equal to the aperture times the effective focal ratio is verified. The various functions of the distance of the secondary from the prime focus may be computed, tabulated in small increments, and plotted on a graph, as a guide to astronomical telescope users. An example is included. P.A.B.

N70-37630*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE CONVERSION OF GODDARD RANGE AND RANGE RATE TRACKING DATA TO METRIC UNITS
J. F. Cook Jun. 1970 46 p refs Submitted for publication
(NASA-TM-X-65314; X-551-70-212) Avail: CFSTI CSCL 12A

The primary purpose of the tracking data conversion described is to permit tracking system analysis prior to orbit computation. The fundamental tracking data recorded during the track of a space vehicle by a ground station seldom directly expresses the physical measurements involved. In order to directly interpret measured tracking data in terms of physical phenomena, prior to orbit or trajectory computation, a conversion of fundamental tracking data to metric form is required. The data conversion capability described in this report was implemented to provide a straightforward means of converting GRARR tracking data to metric form (i.e., range, range rate and angles) free from any data preprocessing such as mathematical smoothing or statistical editing. Such metric data is then used as basic information in post-flight tracking system analysis. Author

N70-37588*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FILM DEGRADATION RESULTING FROM MAGNETICALLY TRAPPED PROTONS IN ATM ORBITS
John W. Watts 16 Sep. 1969 21 p refs
(NASA-TM-X-53922; MSFC-IN-SSL-N-69-2) Avail: CFSTI CSCL 14E

Film degradation resulting from trapped protons in the ATM orbit is considered for five films: 103-0, Plus X, Panatomic-X, SWR, and SO-375. The latest Kodak analysis of the NASA data is used to determine film densities as a function of time in a 210 nautical mile (389 km), 35 deg circular orbit for the films. Dose rates as a function of orbital altitude, inclination, and shield thickness are presented that should be useful in determining film degradation in orbits near the one presented. Film selection is concluded to be the single most important criteria in minimizing data loss due to radiation damage. Author

N70-37698# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TRANSFER FUNCTIONS OF SPECTROZONAL AERIAL FILMS
A. Ya. Smirnov et al 21 Jan. 1970 5 p Transl. into ENGLISH from Zh. Nauch. Prikl. Fotogr. Kinematogr. (USSR), v. 13, no. 1, 1968 p 51–52
(AD-706157; FTD-HT-23-810-69) Avail: CFSTI CSCL 14/5

The frequency-contrast transfer functions were determined of layers of spectrozonal aerial films SN-6, SN-23, and Ektachrome Infrared Aerial Film. The determination method consisted in microphotometry of bands of erosion of the image of a knife-edge through narrow-zonal light filters and obtaining curves of D(X); the curves were recalculated according to data of corresponding sensitometric determinations into curves of E(X). Proceeding from the theory of the boundary function of a jump in brightness, the contrasts were calculated between light and dark shadings in the image of Pi-shaped periodic gratings of different frequency and determined the transfer function. The relative error of determination was about 5 percent. TAB

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N70-36271# Defense Documentation Center, Alexandria, Va.
CHEMICAL MILLING, VOLUME 1 A DDC Bibliography, Dec. 1960 – Dec. 1968
Mar. 1970 133 p refs
(AD-702750; DDC-TAS-70-25-1) Avail: CFSTI CSCL 13/8

The report includes annotated references on the capabilities and limitations of chemical milling techniques, materials for which it is suitable, and the quality of the finished surfaces. Computer-generated indexes of corporate author-monitoring agency subject, and contract are provided. Author (TAB)

N70-36277# Mechanical Technology, Inc., Latham, N.Y.
THE GASEOUS SQUEEZE-FILM AT MODERATELY LARGE SQUEEZE NUMBERS
C. H. T. Pan 10 Apr. 1970 65 p refs
(Contract N00014-70-C-0135)
(AD-704489; MTI-70TR26) Avail: CFSTI CSCL 13/9

The asymptotic analysis of the gaseous squeeze-film bearing was extended to obtain effects in accordance with the isothermal gas lubrication theory and the method of singular perturbation. Corrections are identified to contain not only edge effects (inner problem) but also edge-interior interactions which are analogous to the boundary layer displacement effects in aerodynamics. The latter features can further be recognized to be related to mean-gap taper, squeeze taper, and cross-edge sliding. These results are discussed from the point of view of global bearing properties including the temporal mean as well as the in-phase and quadrature synchronous components of the fluid film force and moment. The edge effects are presented in terms of universal functions which can be used directly as corrections in the global properties. The edge-interior interactions must be determined by solving the asymptotic p.d.e. with boundary condition also expressed in terms of universal functions. Formulations applicable to cylindrical, conical, and spherical bearing geometries are outlined. Illustrative numerical examples are provided. Conditions affecting the validity of the isothermal gas lubrication theory (neglecting inertia effects) as related to the magnitude of the squeeze number are discussed. Author (TAB)

N70-36279# Helsinki Univ. (Finland).
ON THE CRITICAL SPEED OF A SHAFT AS INFLUENCED BY THE SUPPORTS
Seppo K. Veisanen (Ph.D. Thesis) 1969 57 p refs
(APS-ME-48) Avail: CFSTI

A study is made of the critical speeds of a shaft with nonzero mass supported at both ends when the elastic displacements of the bearings are assumed to be non-linear. The general deformation equations, which are valid both in respect of flexural vibration and of various composite rotatory motions, are derived. Dampings are neglected. The cases of nonlinear bearing conditions do not lead to a linear eigenvalue problem as do the ideal and linear cases. In order to find an approximate solution of the problem, the amplitude of deflection of the shaft corresponding to each speed of rotation is considered to be critical at which the amplitude in question exceeds a given allowable deflection which is maximal from the viewpoint of operation of the machine, or at which alternatively the marginal stress exceeds a given, dangerous value. The computer program used here is applicable in determining the combined effect exerted on the deflection and marginal stress of the shaft by the transversal and slope elasticities, consistent with elasticity graphs of arbitrary shape, of bearings of various types and of their supports. Author

N70-36280# Bausch and Lomb, Inc., Rochester, N.Y. Research and Development Div.
LASER DAMAGE STUDY OF THIN FILMS Final Quarterly Report, 29 Nov. 1969 – 28 Feb. 1970
Arthur F. Turner and Edward M. Arlin 28 Feb. 1970 51 p
(Contract N00014-68-C-0190; ARPA Order 306)
(AD-703272; QR-8) Avail: CFSTI CSCL 20/6

Damage thresholds for evaporated ZrO2 films and multilayers, in combination with MgF2 films, were determined using a Q-switched ruby laser. Antireflection and beam divider coatings as well as high reflecting quarterwave stacks were represented in the multilayers tested. Threshold values lie in the 30-40 J/sq. cm range for coatings with up to 15 layers. Beyond this the thresholds decrease. The CO2 laser assembled was improved by introducing O-ring seals for the Brewster windows and by more efficient water cooling. It is stable at 60 W multimode for periods of hours. Semi-quantitative observations were made on metal films of several thicknesses - Ag, Cu, Al, Au and Inconel. Au appears most damage resistant. Inconel films show promise for photographic recording at 10.6 micrometers. Author (TAB)

N70-36308# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FRICTIONAL FORCES ON THE MANDREL IN TUBE ROLLING
A. P. Chektarev et al 20 Mar. 1970 11 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Chernaya Met. (Moscow), v. 12, no. 4, 1969 p 80 – 82
(AD-705229; FTD-MT-24-54-70) Avail: CFSTI CSCL 13/8

A method of experimentally determining the frictional forces in the region outside the main zone of deformation when rolling steel and other metal tubes in a continuous mill with a long mandrel is described. Examples of the use of this method in connection with the frictional forces on alloy steel and A1 tubes are presented, the mandrel being lubricated with either a graphite-oil mixture or pure castor oil. TAB

N70-36311# Avco Corp., Lowell, Mass. Systems Div.
MAGNETIC-CRYSTALLOGRAPHIC ORIENTATION PRODUCED IN FERRITES BY HOT WORKING Annual Report, 15 Mar. 1969 – 14 Mar. 1970
Robert M. Haag 14 Mar. 1970 46 p refs
(Contract N00014-68-C-0364)
(AD-702749; AVSD-0128-70-CR; AR-2) Avail: CFSTI CSCL 11/7

Barium ferrite, strontium ferrite and Ba3Co2-xNixFe24O41 were forged to high density with the development of crystallographic texture. Lead zirconate-titanate (pseudocubic) was forged to high density without development of crystallographic texture. Studies to elucidate the kinetics and mechanism of the densification and orientation processes were conducted. Author (TAB)

N70-36407# Air Force Systems Command, Wright-Patterson AFB, Foreign Technology Div.
THE ROLE OF MECHANICAL FACTORS IN THE PROCESS OF EROSION IN PULSE DISCHARGES
B. N. Zolotykh et al 13 Nov. 1969 Transl. into ENGLISH from the Russian
(AD-703155; FTD-MT-24-304-69) Avail: CFSTI CSCL 13/8

Tests were run to determine the effect of thermal stresses on erosion of tungsten and zirconium carbide in electric spark machining. Results show that these stresses can exceed the tensile strength of the material being treated. Author (TAB)

N70-36409* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
METHOD AND APPARATUS FOR SHOCK PROTECTION Patent
William J. O'Sullivan, Jr. and George F. Pezdirtz, inventors (to NASA) Issued 15 Dec. 1964 (Filed 17 Jan. 1962) 8 p Cl. 29-423
(NASA-Case-XLA-00482; US-Patent-3,160,950;
US-Patent-Appl-SN-166970) Avail: US Patent Office CSCL 13I

A method of protecting delicate instruments or their component parts against heavy acceleration loads, vibrations, and impact loads during transit is described. The assembled instrument is potted or embedded in a solid material which can be removed by sublimation when desired. Local embedding of individual delicate parts can be utilized in cases where extreme shocks are anticipated and can also provide for a time delay in the operation of an assembled device. Polyoxymethylenes are found to be among the suitable embedding materials for use in space exploration. P.A.B.

N70-36411* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FORMED METAL RIBBON WRAP Patent
Casey J. Blaze and Carl G. Richter, inventors (to NASA) Issued 22 Dec. 1964 (Filed 4 May 1961) 5 p Cl. 60-3966
(NASA-Case-XLE-00164; US-Patent-3,162,012;
US-Patent-Appl-SN-107870) Avail: US Patent Office CSCL 13H

With the object of providing an improved high pressure resistant outer shell for a regeneratively cooled combustion chamber, a coolant flow type wall construction and its method of fabrication are described. The outer shell is composed of a closed assembly of adjoining U-shaped channels transversely wrapped by a continuous length of ribbon capable of interlocking with adjacent turns of the ribbon. Brazing of the superposed portions of the adjacent turns of the ribbon and the channel ribs to the ribbon at their contact points is utilized to provide for a leakproof and rigidly interlocked type of shell. The construction is described in connection with reaction motor combustion chambers and other applications where high temperatures and coolant pressures are involved. P.A.B.

N70-36412* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MULTISTAGE MULTIPLE-REENTRY TURBINE Patent
Warner L. Stewart and David G. Evans, inventors (to NASA) Issued 5 Jan. 1965 (Filed 24 Oct. 1962) 8 p Cl. 253-66
(NASA-Case-XLE-00170; US-Patent-3,164,369;
US-Patent-Appl-SN-232914) Avail: US Patent Office CSCL 10A

A multistage axial flow reaction turbine incorporating a reverse flow reentry principle is described, in which the fluid reenters on the same side of the rotor from which it was discharged, the entry being at the upstream side and the exit at the downstream

side of each stage. Multistaging is accomplished by passing the fluid flow through a single rotor several times. Reentry ducts direct the fluid flow between successive stages located in segments around the rotor annulus. The latter stages act to cool the rotor, allowing for high turbine inlet temperatures and high inlet enthalpies. P.A.B.

N70-36416+ Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
ULTRASONIC INSPECTION OF LARGE CAST BRONZE PIECES DESTINED TO THE MACHINING OF LARGE HELICOIDAL GEARS [INSPECAO ULTRA-SONICA DE DISCOS FUNDIDO DESTINADOS A CONFECCAO DE ENGRENAGENS HELICOIDAIS]
H. Onusic and E. J. Cury 13 May 1969 19 p In PORTUGUESE; ENGLISH summary
(Rept-6904.372) Avail: CFSTI

Inspected parts, work scope, and equipment and accessories used for the ultrasonic inspection of cast bronze discs for the construction of large helicoidal gears are described. The results, with defects indicated, are presented in schematic drawings with photographs of detected defects. Author

N70-36421+ Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
INSPECTION AND ACCEPTANCE OF FORGED STEEL GEARS [INSPECAO E ACEITE DE ENGRENAGENS DE ACO FORJADO]
H. Ornusic and Y. M. Alessio 4 Dec. 1969 11 p In PORTUGUESE; ENGLISH summary
(Rept-6911.392) Avail: CFSTI

Ultrasonic inspection of forged steel gears with shear and compressional waves and liquid penetrant inspection with spotchecks and microphoto tests are described. Results are presented with echograms and macrophotographs of the inspected regions. Author

N70-36447+ Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
THICKNESS CONTROL OF DRYING MOGUL CYLINDRICAL RODS [CONTROLE DE CORROSAO EM ROLOS SECADORES DE MOGUL]
H. Onusic, J. Perdiz, M. Barbosa, and J. R. Costa 26 Dec. 1969 15 p In PORTUGUESE; ENGLISH summary
(Rept-6912.396) Avail: CFSTI

The procedures, equipment and accessories adopted for thickness control of drying mongul cylindrical rods are described. The results are presented in schematic drawing form with the indication of the observed thickness in eight rods, and also the photos of the observed echograms. Author

N70-36459 Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
CHEMICAL AND METALLOGRAPHIC ANALYSIS OF SAMPLES OF FORGED CARBON STEEL [ANALISE QUIMICA E METALOGRAFICA DE AMOSTRAS DE ACO AO CARBONO FORJADO]
Y. M. Alessio 10 Oct. 1969 8 p In PORTUGUESE; ENGLISH summary
(Rept-6910.387) Avail: CFSTI

The procedure, equipment, and accessories used in the chemical and metallographic analysis of samples of forged carbon steels are presented. A comparison between the published specifications and the obtained values is given in order to classify the tested material. Author

N70-36492* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FLUID COUPLING Patent
Richard L. De Witt and Harold W. Schmidt, inventors (to NASA) Issued 23 Feb. 1965 (Filed 16 May 1962) 6 p Cl. 137-614
(NASA-Case-XLE-00397; US-Patent-3,170,486; US-Patent-Appl-SN-195346) Avail: US Patent Office CSCL 13K

A two component valve assembly for regulating transfer of cryogenic and corrosive liquids is described. The assembly is composed of a remotely operated valve section which is capable of being quickly connected to or disconnected from a matching stationary section, in order to minimize external leakage and spillage during the transfer operation. P.A.B.

N70-36535* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INJECTOR-VALVE DEVICE Patent
Samuel Stein, inventor (to NASA) Issued 23 Feb. 1965 (Filed 26 Mar. 1962) 9 p Cl. 60-35.6
(NASA-Case-XLE-00303; US-Patent-3,170,286; US-Patent-Appl-SN-182692) Avail: US Patent Office CSCL 13K

An apparatus for cooling and injecting hypergolic propellants into the combustion chamber of a small rocket engine is described. For optimum control of the propellant flow the shut-off apparatus is located as close to the injector as possible. It is further designed to continue the flow of propellant through the tubular members of the engine after flow to the combustion chamber has been stopped. E.M.C.

N70-36556 Eidgenossische Technische Hochschule, Zurich (Switzerland).
THE SERVOMECHANISM BEHAVIOR OF HYDRAULIC COPYING SYSTEMS WITH FOUR EDGE CONTROL [DAS REGELVERHALTEN VON HYDRAULISCHEN KOPIERSYSTEMEN MIT VIERKANTENSTEUERUNG]
Hans Juergen Ulrich (Ph.D. Thesis) 1969 46 p refs In GERMAN
(Diss-4310) Copyright. Avail: Issuing Activity

Studied is the servomechanism for a hydraulic copying system of complicated geometrical shapes in machine tooling. The system incorporates a four directional distributing slide valve piston; servomotor and servovalve are connected with each other by controlled feedback. Direct mechanical input between template and valve keeps energy transfer losses to a minimum. Important parameters of the transfer mechanism are analyzed and experimentally verified by measuring effects of mass, friction, elasticity, etc., on the investigated object shapes. Partly non-linearized differential equations are linearized by the method of variations: describing functions for the carriage guide and piston guide consider Coulomb friction effects on stability. Transl. by G.G.

N70-36656# Atomic Weapons Research Establishment Aldermaston (England).
CLAMP: COMPUTER LISTING AND ANALYSIS OF MAINTENANCE PROGRAMMES
P. A. Jones Jun. 1970 25 p refs
(AWRE-O-59/70) Copyright. Avail: HMSO 3s. 6d; BIS $0.70

The development of maintenance control using a computer is detailed in tabular form. Implementation of the system, its present status, and future possibilities are discussed. E.M.C.

N70-36668# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
STATISTICAL PARAMETRIC AND NON-PARAMETRIC METHODS OF DETERMINING THE RELIABILITY OF MECHANICAL COMPONENTS
D. Basile and G. Volta Jun. 1970 69 p refs
(EUR-4282.e) Avail: CFSTI

Various statistical methods were studied permitting determination of the failure probability distribution of a mechanical component using experimental test data. Parametrical and

nonparametrical methods were considered; particular emphasis was also given to the use of probability papers. Weibull distribution methods are applied to some samples concerning rupture resistance of intermetallic joints and the lifetime of mechanical components. Three digital computer programs (IBM 360/65) were written to determine the Weibull parameters, to rank with a fixed confidence level, and to apply the Kolmogorov test. Author

N70-36672*# Martin Marietta Corp., Denver, Colo.
PORTABLE ASTRONAUTS TEST KIT, VOLUME 1 Final Report
R. M. Belless, Jr. May 1970 203 p refs
(Contract NAS8-24296)
(NASA-CR-102640; MCR-69-618-Vol-1) Avail: CFSTI CSCL 13I

A full-scale, demonstration mockup of a Portable Astronaut Test Kit (PATK) was developed to be used by astronauts to perform maintenance actions during space missions. The PATK is basically a fabricated aluminum housing that contains and provides tools, test equipment, portable lights, work shelves, spare parts, a wall mounting boom, visual maintenance instructions, and an astronaut carrying handle. It weighs approximately 57 pounds, and is designed to be transported and used by one astronaut for performance of inplace scheduled and unscheduled maintenance requirements. Kit size and configuration are designed for safe, easy handling; passage through a 24"-diameter opening; and effective presentation of kit contents to an astronaut limited to one-handed operations. Author

N70-36697*# General Electric Co., New York.
ELECTROFORMING OF LARGE MIRRORS
F. J. Schmidt *In* NASA, Washington Opt. Telescope Technol. 1970 p 165-171 (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 13H

The fabrication of large metallic mirrors for space telescopes by electroforming is described. In electroforming, metal ions are deposited from a room temperature solution upon an accurate male master. Electrodeposition stresses are controlled by using a double replication process: spincast epoxy female master, electroformed male nickel intermediate, and electroformed female final replica. Large scale structural electroforms are reinforced by electrophoretic codeposition of high strength fibers. Proposed is the lunar fabrication of silica or rigid metal mirrors. G.G.

N70-36754*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DEGRADATION DUE TO CONTAMINANTS THROUGHOUT THE TEST CYCLE
Fred W. Paul *In its* Opt. Telescope Technol. 1970 p 751-757 (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 14D

The different techniques used to determine whether contamination has occurred during fabrication of spacecraft components and systems are discussed. Recommendations are made for contamination tests that can be directly related to expected performance in space and for establishment of realistic tolerance levels. R.B.

N70-36776*# Tennessee Univ., Knoxville. Dept. of Mechanical and Aerospace Engineering.
A STUDY OF CONVECTIVE INERTIA EFFECTS AND METHODS OF CONTROLLING GAS INGESTION IN LARGE DIAMETER VISCOSEALS
Lawrence Howard Luttrull (M.S. Thesis) Mar. 1970 57 p refs
(Grant NGR-43-001-003; Contract N00014-68-A-0144)
(NASA-CR-12675; ME-70-T57-10) Avail: CFSTI CSCL 13G

The effect of characteristic length and aspect ratio on the performance of large diameter viscoseals was investigated as well as methods of preventing or controlling gas ingestion. The characteristic length, or length of the groove-land pair in the direction of seal rotation and the aspect ratio, or ratio of groove width to groove depth, arose as parameters likely affecting viscoseal performance in a viscoseal analysis which included convective inertia terms. Two series of three seals each were tested. Results show that the characteristic length had a negligible effect on viscoseal performance. The aspect ratio affected performance in the transition region where a higher aspect ratio produced a lower transition Reynolds number. Two methods of controlling or preventing gas ingestion in viscoseals were studied. In one, a centrifugal separator was designed into a viscoseal which had already been tested for performance and gas ingestion rate. Results show that the separator reduced gas accumulation in the sealed cavity by an order of magnitude while further modification resulted in an additional reduction of about 30% to 40%. The separator had a negligible effect on sealing performance. Another method of controlling ingestion involved a backflow of fluid from the high pressure to the low pressure end of the viscoseal. Author

N70-36864*# TRW Systems Group, Redondo Beach, Calif.
THERMALLY ACTUATED VALVES Final Report, 15 Dec. 1969 - 15 Jul. 1970
Jul. 1970 135 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952762)
(NASA-CR-112874; TRW-14936-6001-R0-00) Avail: CFSTI CSCL 13K

The results of a program to study, design, fabricate, and evaluate two types of thermally actuated valves are presented. The high pressure and vacuum valves developed are applicable to spacecraft instrumentation packages or other applications requiring a small zero leakage valve. The valves meet the design goals of leakage, power, and response requirements. R.B.

N70-36901* National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
CATALYST BED REMOVING TOOL Patent
James B. Newman, inventor (to NASA) Issued 26 Jan. 1965 (filed 8 Feb. 1963) 5 p Cl. 29-234
(NASA-Case-XFR-00811; US-Patent-3,166,834;
US-Patent-Appl-SN-257346) Avail: US Patent Office CSCL 13I

A removing tool is described which comprises a collet having an elongated threaded shank together with a cylindrical member disposed about the shank. An alignment space fits on the outer end of the cylinder; when a knurled knob threaded onto the end of the shank is turned, the cylinder moves axially of the collet. A tapered surface on the gripping portion of the collet provides for the cylinder to override this portion and compress the collet to firmly grip a flange. Continued turning of the knob slides the cylinder over the collet and applies a longitudinal force to the flanged element while firmly gripping the element by the collet, so as to withdraw the element without damage. The tool is particularly intended for catalyst bed element removal, such as in power units generating steam by the chemical decomposition of hydrogen peroxide. P.A.B.

N70-36908* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HIGH PRESSURE FOUR-WAY VALVE Patent
William F. Mac Glashan, Jr. and Harry J. Margraf, inventors (to NASA) Issued 14 Jul. 1964 (filed 20 Apr. 1961) 4 p Cl. 137-625.69 Sponsored by NASA
(NASA-Case-XNP-00214; US-Patent-3,140,728;
US-Patent-Appl-SN-180377) Avail: US Patent Office CSCL 13K

A high pressure valve is described in which the arrangement of the inlet port construction permits an O-ring to pass across the inlet or outlet port without danger of dislodgement. The annular nature of the inlet port causes the force of the incoming fluid to

be evenly distributed against the O-ring. Because the inlet port is narrower than the central lands, the flow is momentarily restricted to assist movement of the O-ring past the inlet port. The valve is particularly adapted for four-way valves operating under high pressure differentials, but is also applicable to three-way valves or to normally open or normally closed line valves. P.A.B.

N70-36947* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ELASTIC UNIVERSALJOINT Patent
Edwin Y. Chow and Robert M. Bamford, inventors (to NASA) Issued 16 Feb. 1965 (filed 7 Mar. 1962) 5 p Cl. 189-36
Sponsored by NASA
(NASA-Case-XNP-00416; US-Patent-3,169,613;
US-Patent-Appl-SN-180395) Avail: US Patent Office CSCL 13I

An elastic universal joint, adapted for the mounting of a rocket motor in a supporting structure to permit limited angular displacement of the rocket motor and thus effect vehicle guidance is described. Parts which must slide or roll with respect to each other are eliminated. The axially compact joint utilizes flexure plates arranged in an axially overlapped relation, allowing the rocket motor to move about two mutually perpendicular axes. The joint is adapted to withstand high compression loads without affecting its flexibility, so that the thrust of the rocket motor may be transmitted entirely through it to the rocket vehicle. It can be arranged in such a manner that space is provided for passage of fuel lines to the rocket motor in close relation to the motor's longitudinal axis. P.A.B.

N70-37217# IIT Research Inst., Chicago, Ill.
PRELIMINARY STUDY OF AN AUGMENTED RAM-WING VEHICLE CONCEPT Final Report, 1 Aug. 1967–18 May 1968
Imants Reba Jan. 1970 126 p refs
(Contract DOT-7-33512)
(PB-189425; IITRI-J6128-FR) Avail: CFSTI CSCL 13F

One model studied represented a thick vehicle configuration with a blunted rear end. The second had a streamlined chord section. Blowing arrangements consisted of two two-dimensional Coanda nozzles, one placed near the leading edge and one near the midchord. Upward, downward, and mixed blowing arrangements were investigated. The results indicate that the downward blowing near the leading edge and upward blowing at midspan constitute the most promising of those arrangements investigated. With this arrangement the vehicle has high lift capability at zero forward speed and low drag characteristics at all forward speeds. A range of blowing and pressure coefficients at which a considerable increase in lift-to-horsepower ratio takes place also exists. Similarly, blowing arrangements and blowing coefficients that detrimentally affect power economy also exist. Author (USGRDR)

N70-37254# Argonne National Lab., Ill.
FACTORS INFLUENCING DROSS FORMATION IN THE FUSIBLE SEALS OF THE EBR-2 ROTATING PLUGS
W. E. Ruther Jan. 1970 15 p refs
(Contract W-31-109-eng-38)
(ANL-7653) Avail: CFSTI

The factors influencing the rate of dross formation were studied in the laboratory using a rotating cylinder in a beaker of the fusible alloy Bi-42 wt% Sn. The results indicated that dross formation in a simple rotating system may be a complex process. A single, linear oxidation rate was found for only those few experiments in which the oxidation product did not mechanically interact with the rotor. In the more general case, the mechanical interaction of the dross with the rotating system resulted in substantially greater oxidation rates after an initial period of operation. The oxidation rate during the initial period was shown to be linearly related to circumferential velocity of the rotor in the range of velocities examined in the EBR-II and to be independent of the rotor size. The secondary oxidation rate was linearly related to velocity for a given rotor, but was dependent on rotor size. No large effect of alloy composition on the secondary oxidation rate was found when the tin content was varied or when aluminum was added. Indium proved effective in reducing the rate of dross formation in the basic alloy. Author (NSA)

N70-37321# South Carolina Univ., Columbia. Coll. of Engineering.
THE FEASIBILITY OF PRESSING ALUMINUM POWDER IN POROUS LINED DIE
Lewis R. Goodwin (M.S. Thesis) 1970 46 p refs
(Contract AT(38-1)-475)
(PB-191702; SRO-475-6) Avail: CFSTI CSCL 13H

An experimental study is made of the feasibility of cold pressing unlubricated aluminum powder in a porous lined die. Results of lubricant flow through the porous liner are given and discussed. A comparison is presented of two lubricants, butyl stearate and a 6% solution of stearic acid in trichloroethylene, and their effectiveness in reducing die wall friction in a porous lined die. Finally, the results of compacts made in a porous lined die are compared with the results of compacts made in a solid tooled die of identical geometry. Author (USGRDR)

N70-37359# Atomic Energy Establishment, Winfrith (England). Control and Instrumentation Div.
NOTE ON THE VACUUM PROCESSING OF MAGNESIA INSULATED CABLES AND ASSOCIATED COMPONENTS
K. W. McMinn Feb. 1970 9 p refs
(AEEW-M-959) Avail: AEC Depository Libraries

The emission of gases during the vacuum processing of mineral insulated cables is estimated. From a consideration of pumping speeds and desired pressures in a typical situation, conclusions on vacuum system requirements are drawn. These requirements are particularly needed for magnesia-insulated cables used with in-pile ionization chambers. NSA

N70-37374# Bureau of Radiological Health, Rockville, Md. Div. of Electronic Products.
SURVEY OF SELECTED INDUSTRIAL APPLICATIONS OF MICROWAVE ENERGY
May 1970 79 p refs
(PB-191394; BRH/DEP-70-10) Avail: CFSTI CSCL 13H

A survey was made of the industrial applications of microwave energy. This report reviews some of the features of microwave processing, describes the types of industrial microwave equipment, and discusses the uses to which microwave energy is being applied. Considerable emphasis is placed upon the safety features built into the equipment, and recommendations are made for ensuring that the radiation leakage levels do not exceed the design limits. Author (USGRDR)

N70-37478*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TITANIUM 8AI-1Mo-1V CROSSBEAM REPAIR
Ronald L. Nichols 12 Sep. 1969 24 p
(NASA-TM-X-53882; MSFC-R-ME-IN-67-3) Avail: CFSTI CSCL 13H

The application of 40 percent of maximum test loads to the 8Al-1Mo-1V titanium crossbeam resulted in the appearance of cracks in several positions. To obtain meaningful test data from the structure and to continue the testing program, it was necessary to repair these cracked areas. The repair required the removal of all cable feed-through cylinders and necessitated the welding of duplex annealed titanium panels into the vacancies. Cracks in the vertical seams and burn-through welds were mechanically removed, holes were filled with titanium weld. Author

N70-37499*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DEVELOPMENT OF METHODS FOR APPLICATION OF POLYURETHANE SPRAY FOAM INSULATION SYSTEMS TO LIQUID HYDROGEN TANKS
James M. Carter 12 Sep. 1969 62 p
(NASA-TM-X-53897; MSFC-IN-ME-69-3) Avail: CFSTI CSCL 13H

The methods are presented for insulation of a liquid hydrogen container with polyurethane spray foam. The spray foam equipment and its operation, the methods and techniques for application of spray foam to the surface of the tank, and the sealing of the external surface of the foam are described. Several test items which were insulated with polyurethane spray foam and general results of cryogenic testing of the insulation system are discussed. Author

N70-37503*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EVALUATION OF INSTALLATION VARIABLES FOR TITANIUM 6 Al-4V HI-LOKS AND SIX-WING BOLTS ASSEMBLED IN TITANIUM 8 Al-1Mo-1V SHEET MATERIAL
Carl M. Wood 12 Sep. 1969 86 p
(NASA-TM-X-53893; MSFC-IN-ME-68-15) Avail: CFSTI CSCL 13E

Development studies are described, conducted to establish manufacturing process parameters for the installation of titanium 6Al-4V Hi-Lok fasteners and Six-Wing bolts in structures made from titanium 8Al-1Mo-1V alloy material. Fasteners were tested in two thicknesses of material for hold tolerance, hole angle, induced defects, and a combination of 5 percent salt spray and induced defects. The study indicated that close tolerance holes and minimum hole angles result in the highest yield strength and minimum ultimate strength; incuded defects and corrosion tests had no appreciable effect on the joint strength. Author

N70-37508*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ROLL DIFFUSION BONDING DEVELOPMENT
Carl M. Wood 12 Sep. 1969 42 p ref
(NASA-TM-X-53890; MSFC-IN-ME-68-4) Avail: CFSTI CSCL 13H

The object of this study was to extend the state-of-the-art of roll diffusion bonding. Three extremely close fitting packs with different yoke configurations were fabricated, assembled, reduced 60 percent in thickness by hot rolling, and then evaluated. The test articles showed end separation and deformation of the fabricated part near the sides. These were not a result of yoke geometry or a loose fitting, but appeared to be inherent characteristics from the rolling operation. Author

N70-37543*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SIMULATION TEST REPORT FOR THE MULTIPLE DOCKING ADAPTER PACKAGE-FASTENING DEVICES
12 Sep. 1969 21 p
(NASA-TM-X-53888; MSFC-IN-R-ME-67-12) Avail: CFSTI CSCL 13E

An evaluation of design concepts for package-fastening devices was conducted in the Manufacturing Engineering Laboratory's zero g engineering mock-up. The tests were performed on the following items: (1) Douglas Aircraft Corporation's (DAC) grid and hook fasteners, (2) the Martin Company's Deutch screw, (3) McDonnell Aircraft Corporation's captive screw, and (4) Marshall Space Flight Center's (MSFC's) quick release nut. The DAC grid and hook package-fastening device was the optimum design concept in the neutrally buoyant environment. Author

N70-37547*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPACE TOOL POWER SOURCE INVESTIGATION
12 Sep. 1969 28 p refs
(NASA-TM-X-53883; MSFC-R-ME-IN-67-4) Avail: CFSTI CSCL 13I

An investigation into the classes of tools suitable for use in in-space manufacture, assembly, maintenance and emergency repair is covered. The tools are divided into categories by type of motion, class of usage, and mode of input motion. The power requirements of these tools are then studied and several power sources are discussed. An optimum power source is described, and trade-off equations are developed to cover future proposed power sources. One of the conclusions drawn in this report is that electrical power gives the most promise for space tools. Author

N70-37549*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EVALUATION OF RADIOGRAPHIC FLAW DETECTION IN 2219 ALUMINUM TIG WELDS
Tom Goldsberry and Jerry Barnes 9 Sep. 1969 19 p Prepared by SPACO, Inc.
(Contract NAS8-20081)
(NASA-TM-X-53880; MSFC-IN-R-QUAL-67-19) Avail: CFSTI CSCL 13H

The project to evaluate radiographic weld flaw detection in S-IC 2219 aluminum TIG welds is described. Destructive test specimens were incrementally milled and evaluated. Flaws were plotted in there dimensions with respect to size and location. Radiographic and metallographic data were compared and evaluated. It was concluded that radiography has a good level of reliability for porosity dection in the subject weld material, but can be readily improved by attaining film sensitivity levels in the order of 1 percent. Author

N70-37574*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPACE TOOL POWER SOURCE SAFETY AND RELIABILITY INVESTIGATION
12 Sep. 1969 55 p refs
(NASA-TM-X-53889; MSFC-IN-R-ME-68-3) Avail: CFSTI CSCL 13I

The tools will be used in space for operations such as manufacture, assembly, maintenance, and emergency repair. The criteria for this study are safety and reliability of gas, electric, and hydraulic power systems. The potential hazard of each energy medium is discussed. The hydraulic power system presents a major fire hazard. The gas power system may produce toxicants if exhaust gases are expelled in the spacecraft environment. The electric power system may create ozone, a toxic gas, particularly when brush arcing takes place. One recommendation is to use a brushless dc power system using a solid state electronic switching system to replace the brush-commutated dc motor, thereby eliminating brush arcing. Author

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N70-36319# Illinois Univ., Urbana. Dept. of Electrical Engineering.
MOLECULAR LASER STUDIES IN THE FAR INFRARED Interim Technical Report, 1 Oct. 1968 – 30 SEP. 1969

Paul D. Coleman 30 Sep. 1969 89 p refs
(Grant AF-AFOSR-1147-66)
(AD-703749; AFOSR-70-0869TR) Avail: CFSTI CSCL 20/5

Experimental work on SO2, H2S, and the boron trihalide, molecular lasers operating in the far infrared is reported along with chemical excitation of molecules by atomic nitrogen. Attempts at laser line assignments in SO2 are discussed. Cascade-competition and precision wavelength measurements in H2S were studied. A model for gain saturation under pulsed laser conditions is presented. Also given are the publications and personnel associated with this research. Author (TAB)

N70-36337# Michigan Univ., Ann Arbor. Radar and Optics Lab.
INVESTIGATION OF HOLOGRAPHIC TESTING TECHNIQUES Semiannual Report, 1 Jun.–30 Nov. 1969
Emmett N. Leith and Charles M. Vest Apr. 1970 73 p refs
(Contract DAAG46-69-C-0017; ARPA Order 1245)
(AD-705228; Rept-2420-9-P; SAR-2) Avail: CFSTI CSCL 14/2

The report includes studies of interferometric detection of stress corrosion cracking, testing of honeycomb sandwich structures, techniques developed for pulsed-laser contouring and interferometry, laser speckle reduction in interferometry, modulated reference-wave holography, and flaw detection. Holographic interferometry has been used to detect initiation of stress corrosion, monitor the progressing of delayed cracking, and detect bond defects in an aircraft trim tab of honeycomb structure. The several theoretical and experimental investigations conducted include the development of multiple-wavelength holographic interferometry, the study of techniques for improving interferometry of three-dimensional transparent objects, the application of modulated reference-wave holography to vibrating diffusely reflecting objects, and the application of hologram interferometry to detection of flaws in cylindrical steel objects. Author (TAB)

N70-36539# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ENERGY CHARACTERISTICS OF RUBY LASER RADIATION
N. V. Grevtsev et al 20 Mar. 1970 18 p refs Transl. into ENGLISH from Fiz. Khim. Obrabotki Materialov (USSR), no. 6, 1968 p 13–20
(AD-705263; FTD-MT-24-37-70) Avail: CFSTI CSCL 20/5

An experimental study was done on the energy characteristics of ruby laser radiation and its distribution in time and space. TAB

N70-37034# Eidgenossische Technische Hochschule, Zurich (Switzerland).
EXPERIMENTAL INVESTIGATIONS OF STATISTICAL FLUCTUATIONS IN CONTINUOUS-WAVE GALLIUM ARSENIDE LASER DIODES
Goerge Guekos (Ph.D. Thesis) 1969 92 p refs
(Diss-4350) Avail: CFSTI

The statistical intensity fluctuations of the laser beam from semiconductor laser junctions and the phenomena associated with these fluctuations is investigated and suitable means to reduce effectively the noise present in the laser light of a given laser diode are found. After a preliminary and simplified discussion of the theory of intensity fluctuations in lasers, the various experiments carried out with cw GaAs laser diodes are discussed. In these diodes, the laser oscillation is not uniform over the whole width of the junction but takes place over a relatively small cross-section. Such a region is termed a lasing filament. The experiments show that the filamentary laser action is greatly responsible for the high high excess noise level encountered in the laser radiation. This noise is found to be correlated to the laser diode current. This fact represents an important experimental discovery since it is used to eliminate to a large extent the amplitude fluctuations in the laser beam. The Bose-Einstein statistical distribution of the photons due to radiation emanating from various thermal sources has been investigated. A single mode He-Ne laser beam is used to measure the intensity fluctuations of the laser beam and a method is presented which leads to a reduction of these fluctuations. Author

N70-37106# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Lab. Gas Ionizzati.
INTERACTION OF INTENSE LIGHT PULSES WITH SOLID MATERIALS
A. Caruso Dec. 1969 28 p refs Presented at the Workshop on Laser Interaction and Related Phenomena, East Windsor Hill, Conn., 1969
(LGI-69/17) Avail: CFSTI

This report considers some of the phenomena occurring during the interaction of a light pulse with a solid target. The expansion wave reaches the boundary of the heat wave in a finite time t sub 0 at a distance l sub 0 from the initial boundary surface of the solid. To evaluate t sub 0 and l sub 0 the initial target was represented as a cold plasma with the density of a solid. The interaction of short light pulses with solids and the interaction of light pulses with solids in the nanosecond range are discussed. ESRO

N70-37108# Southampton Univ. (England). Dept. of Mathematics.
CONSTRUCTION OF A LASER VELOCIMETER
C. Greated 1969 15 p refs Sponsored by Sci. Res. Council
(RR-69-1) Avail: CFSTI

This report describes the electrical circuits and optical details of a laser velocimeter which has been constructed and used to measure turbulence statistics in water flow. A frequency-voltage converter gives an output which is a direct measure of the instantaneous velocity in the mean flow direction. Author (ESRO)

N70-37221# National Bureau of Standards, Boulder, Colo. Atomic Frequency and Time Standards Section.
HYDROGEN SPIN EXCHANGE FREQUENCY SHIFTS
Helmut Hellwig Mar. 1970 15 p refs
(NBS-TN-387) Avail: SOD $0.30 Catalog No. C13.46:387

Frequency shifts due to hydrogen spin exchange collisions are discussed for the hydrogen maser and the hydrogen storage beam tube. The combined effects of spin exchange and cavity pulling in the hydrogen maser are evaluated with emphasis on frequency errors introduced by standard tuning procedures. It is found that an automatic cavity tuning system based on a variation of the linewidth does not introduce a frequency error. In contrast, manual tuning procedures based on an interpolation of measurements at different cavity settings do not yield a perfect compensation of spin exchange effects. However, the frequency error becomes only significant at unnecessarily large cavity offsets. The smallness of the spin exchange shifts and the near absence of cavity pulling in a hydrogen storage beam tube are expected to permit a determination of spin exchange shifts by varying the beam intensity with a precision adequate for stability and accuracy figures of 10 to the −14th power or better. Author

N70-37316*# Arkansas Univ., Fayetteville. Dept. of Electronics and Instrumentation.
A FEASIBILITY STUDY ON DETERMINATION OF THE DEVIATION FROM LEVEL UTILIZING OPTICAL INTERFERENCE CREATED BY A LASER SOURCE
George H. Cline (M.S. Thesis) 1971 73 p refs
(Grant NGL-04-001-007)
(NASA-CR-73473) Avail: CFSTI CSCL 20E

The feasibility was investigated of using the interference effects within an optical wedge, one side of which is a liquid surface, to determine the exactness to which a geoid perpendicular

to the force of gravity at any point in an existing gravitational field can be approached. Interference phenomena characteristics were studied resulting from specific materials used as the source, surfaces, and wedge composition in an effort to test the feasibility of using these characteristics to establish an object's degree of deviation from level. The purpose is to determine if a more practical, sensitive, accurate, and readily automated leveling device can be developed. A literature survey of off-level measuring methods is discussed and the optical interference level is described. The theory and affecting variables are considered mathematically. The optical wedge, maximum sensitivity and accuracy, maximum detectable angle, and the two sources separated in depth are outlined as well as information on the reflection from the upper surface of the flat. Experimental data equipment, and alignment procedures are presented. J.M.

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N70-36201# Boeing Co., Renton, Wash. Commercial Airplane Div.

EVALUATION OF ARMCO PH13-8Mo

Jack M. Uchida 19 Nov. 1969 33 p

(AD-700762; D6-23927) Avail: CFSTI CSCL 11/6

The PH-13 13-8 Mo is a precipitation hardenable stainless steel. This steel can be heat treated to 225 ksi and has excellent toughness, general corrosion, and stress corrision at this strength level. The fatigue life is comparable to 4330 in both the smooth and notched conditions. Exposure to temperatures in the 800 to 900F range for extended times reduces the toughness of this steel and use in this temperature range is not recommended. Author (TAB)

N70-36255# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THERMAL STABILITY OF HEAT-RESISTANT CERMET MATERIALS AS HEAT SHIELDING COATINGS

M. K. Rybalchenko 12 Dec. 1969 18 p refs Transl. into ENGLISH from the Russian

(AD-702945; FTD-MT-24-311-69) Avail: CFSTI CSCL 11/3

Thermal stability is not just a property of a material, but also depends on the dimensions and the form of articles made from the given material: the thermal stability of articles with identical dimensions according to various directions is higher than with a sharp distinction of these dimensions; the thermal stability of articles of identical form increases with a decrease in the dimensions of article. Thermal stability of titanium carbide alloys with nickel increases with an increase in the content of nickel and with an increase in the sintering point. A pattern in the change of electrical resistance during thermal cycling, was established: the increase in the electrical resistance is proportional to the number of thermal cycles. Thermal stability increases with an increase in the plasticity (decrease of brittleness) of the material. New principles of producing materials for new technology have been developed. Author (TAB)

N70-36293# Oak Ridge National Lab., Tenn.

FACTORS AFFECTING THE SWELLING DURING DEGASSING OF COMPACTS CONTAINING URANIUM-ALUMINUM INTERMETALLICS DISPERSED IN ALUMINUM

A. K. Chakraborty, R. S. Crouse, and W. R. Martin Mar. 1970 26 p refs

(Contract W-7405-eng-26)

(ORNL-TM-2800) Avail: CFSTI

Swelling of dispersions of UAl3 in aluminum was investigated by dilatometry, measurement of gas evolution, electrical conductivity, heating-stage metallographic examination, and electron-beam microprobe analysis. The swelling occurs in two stages. In the first, the swelling is gradual and believed to be due to adsorbed gases that are released from the surfaces of the aluminum and UAl3 powder particles. After a varying incubation time, the second stage of swelling at a greatly increased rate begins. This incubation period increases with increasing UAl3 particle size and decreasing temperature. The second stage is due to the transformation of the UAl3 to UAl4 through reaction with the aluminum matrix. The stability of UAl3 containing either Si, Ge, Sn, or Zr was investigated. The results show silicon and germanium to be the most effective stabilizers within the range of approximately 5 to 6 wt %. Tin was effective at approximately 1.5 wt %, but higher concentrations were detrimental. Zirconium was ineffective for concentrations up to approximately 6 wt %, but a 14 wt % alloy was stable. Author (NSA)

N70-36310# Naval Research Lab., Washington, D.C.

CHARPY-V NOTCH DUCTILITY CHARACTERISTICS OF NEUTRON-IRRADIATED A537-B AND A350-LF2 STEEL WELDMENTS

Robert A. Gray, Jr. 15 Oct. 1969 16 p refs

(Contract AT(49-5)-2110)

(NRL-7006) Avail: CFSTI

The nuclear service performance of thin structural steel plate irradiated at 150 F to a fluence of 2.5 × 10 to the 18th power neutrons/sq cm of energies greater than 1 MeV has been examined and documented with experimental results. Five 3/4-inch A537-B steel plates, an A350-LF2 forging, and weldments of both types of steel provided the specimen stock for the irradiation assessments. The two steels responded to low-temperature irradiation in a manner similar to a well-documented A212-B pressure vessel steel. However, both A537-B and A350-LF2 steels have an inherently greater tolerance to the effects of irradiation damage by virtue of their lower initial transition temperature. Embrittlement due to irradiation produced increases in transition temperature, but for no component of the weldments studied was the 30-ft-lb value greater than 65 F. The postirradiation assessments of the Charpy-V notch shelf energy values of A537-B plate in the ASTM WR orientation (weak direction) revealed a marked reduction in the steel's fracture resistance at maximum (shelf-level) ductility. Author (NSA)

N70-36386# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

LIGHTWEIGHT ALLOYS AND THEIR TREATMENT METHODS

M. L. Khenkin *et al* 11 Dec. 1969 31 p refs Transl. into ENGLISH from the Russian

(AD-703156; FTD-MT-24-322-69) Avail: CFSTI CSCL 11/6

Contents: Investigation of measured stability of deformed aluminum alloys; Nature of the fracture of cast aluminum alloys at different rates of deformation. TAB

N70-36417# Southwest Research Inst., San Antonio, Tex. Dept. of Instrumentation Research.

NONDESTRUCTIVE EVALUATION OF METAL FATIGUE Final Scientific Report

F. N. Kusenberger, J. Lankford, Jr., P. H. Francis, and J. R. Barton Mar. 1970 72 p refs

(Contract *Af* 49(638)-1502)

(AD-705653; AFOSR-70-1206TR) Avail: CFSTI CSCL 11/6

Attention is called to the significance of localized defects in the development of fatigue damage in metals of engineering interest. In this regard, recent studies, conducted both in air and in vacuo using nondestructive evaluation techniques, have established the influence of surface and near-surface inclusions on crack initiation in AISI 4340 steel. Accompanying metallurgical investigations indicate that bonding at the inclusion-metal matrix interface is crucial to crack initiation and is followed in order of importance by inclusion size and inclusion depth below the specimen surface. The relationship to and the significance of ultrasonic and magnetic perturbation nondestructive evaluation results in terms of fatigue crack development are discussed. An earlier analytical treatment of the growth of surface fatigue microcracks is extended to describe the configuration of the propagating crack, and an approximate analysis has been initiated to ascertain the extent of plastic yielding expected in the neighborhood of a hemispherical cavity. A historical review of the nondestructive evaluation technique development and crack propagation analysis efforts, which were previously conducted under this contract, is also presented. Author (TAB)

N70-36470# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE COLD-ROLLING TEXTURE OF ALLOYED TITANIUM

V. V. Mukhaev et al 4 Mar. 1970 17 p refs Transl. into ENGLISH from Akad. Nauk SSSR. Izv. Metally (USSR), no. 6, 1968 p 98–104

(AD-703769; FTD-HT-23-41-70) Avail: CFSTI CSCL 11/6

An essential difference was established in the textures of cold rolling of VT-1, VT5-1, and OT4-1 titanium alloys, which is related to changes in the mechanics of their plastic deformation under the effect of alloying elements. The heterogeneity of the rolling texture over the cross section of the specimen in the alloys under study is retained to the point of wide deformation; in the VT5-1 alloy the texture was found to be heterogeneous at all deformations studied (up to 70 percent). Intensive development of texture formation in VT1-1, VT5-1 and OT4-1 alloys begins in the 50-60 percent deformation region. The importance of studying titanium alloys of various composition is stressed since it provides additional information on the effects of alloying elements on the texture of rolling. All research published in the past on this subject was conducted basically after high deformations. Author (TAB)

N70-36583# National Engineering Lab., Glasgow (Scotland). Computer Stress Analysis and Creep Div.

SIX-YEAR CREEP TESTS AT 350 C ON UNALLOYED FLAKE GRAPHITE CAST IRONS

D. B. Campbell and K. B. Palmer Aug. 1969 24 p refs

(NEL-428) Copyright. Avail: CFSTI

Creep and stress-rupture tests on unalloyed flake graphite cast iron were undertaken for periods of up to six years (53,000 h), to provide data on which the permissible temperature at which this material may be used may be determined. Data obtained from over a million hours' testing, on fifty-eight creep and stress-rupture testpieces for times extending to 3-1/2 years (30,000 h data), and for periods of up to 6 years (50,000 h data) show that this BS.1452, Grade 17, grey cast iron has good creep properties at 350 C which make it suitable for use up to this temperature in applications in which close dimensional stability is required. Author

N70-36616* National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

NICKEL-BASE ALLOY Patent

John C. Freche, Thomas J. Riley, and William J. Waters, inventors (to NASA) Issued 26 Jan. 1965 (filed 4 May 1961) 4 p Cl. 75-171

(NASA-Case-XLE-00283; US-Patent-3,167,426; US-Patent-Appl-SN-107866) Avail: US Patent Office CSCL 11F

An alloy series is described which has high stress rupture, and tensile strength, impact resistance, and high load carrying capability at temperatures of 1800 F and above. The alloys are also workable and castable. The alloys have the composition within the following range: nickel, 60-75%; molybdenum, 0-10%; tungsten, 0-10%; aluminum, 4-8%; chromium, 4-8%; zirconium, .5-3%; vanadium, 1-7%; carbon, 5.0-1.0%; and tantalum, 3-12%. The molybdenum and tungsten must be present individually or in combination in a quantity of at least 6% and not more than 10%. N.E.N.

N70-36653 National Lending Library for Science and Technology, Boston Spa (England).

ELECTROPHORESIS

M. Zatmann 24 Jun. 1970 11 p Transl. into ENGLSIH from Trait. de Surface, v. 11, Jan.–Feb. 1970 p 3–13

(NLL-M-9217-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupons

The colloidal properties of paints for electrodeposition are discussed in terms of pigment, binder, and solvent. A physico-chemical concept of a dispersion of silica micelles in water containing soda is presented. Reactions on the anode are considered to be a phenomenon of the insolubility of micelles, and not the electrolysis of water. F.O.S.

N70-36658*# National Aeronautics and Space Adminstration, Langley Research Center, Langley Station, Va.

COMPRESSIVE AND COLUMN STRENGTHS OF ALUMINUM TUBING WITH VARIOUS AMOUNTS OF UNIDIRECTIONAL BORON/EPOXY REINFORCEMENT

H. Benson Dexter Washington Aug. 1970 33 p refs

(NASA-TN-D-5938; L-7131) Avail: CFSTI CSCL 11F

Compressive-crushing and column-buckling tests were performend on aluminum, aluminum reinforced with varying amounts of boron/epoxy, and 11-ply all-boron/epoxy tubes. All tubes were designed to be approximately equal in mass per unit length. The boron/epoxy-aluminum tubes consisted of two, four, six, eight, and 10 plies of boron/epoxy bonded to the outer surface of a series of aluminum tubes with variable diameters and wall thicknesses. Compressive-crushing strength increased approximately linearly with increasing reinforcement from about 46 ksi for an all-aluminum tube to about 380 ksi for an all-boron/epoxy tube of approximately equal mass. Column-buckling strengths for the reinforced tubes were adequately predicted when a shear correction was made to account for the low shear stiffness of the unidirectional boron/epoxy. Author

N70-36698*# Stanford Research Inst., Menlo Park, Calif.

ISOTROPIC BERYLLIUM FOR MIRROR BLANKS

John W. Moberly and Henry M. Brown *In* NASA, Washington Opt. Telescope Technol. 1970 p 173–179 refs (See N70-36676 20-14)

Avail: CFSTI HC$10.00/MF$0.65 CSCL 11F

Pressureless-sintering and hot-isostatic pressing processes are advocated for producing polycrystalline beryllium mirror surfaces of stable optical performance. X-ray diffractometer scans of both types of beryllium mirrors show the superiority of pressureless-sintered mirror surfaces. G.G.

N70-36768# Israel Program for Scientific Translations, Ltd., Jerusalem.

A COMPENDIUM OF CONSTITUTIONAL TERNARY DIAGRAMS OF METALLIC SYSTEMS

W. Guertler et al 1969 712 p refs Transl. into ENGLISH from

German report Sponsored in part by DOC and NSF
(Contract AF 61(052)-74)
(TT-69-55069; WADC-TR-58-615-Pt-1-3) Copyright. Avail: CFSTI HC$10.00/MF$0.65

A complete collection of ternary phase diagrams of the various metallic systems is presented. The ternary diagrams presented are built from available binary diagrams, in each instance the most reliable binary diagram was selected. The basis for the designation of the pages is the order of atomic numbers. It is thus possible to attribute to each ternary alloy three numbers below 100 corresponding to the three combining elements and to assemble them in order of magnitude from the smallest to the highest figure. Consequently each system can be located easily. E.M.C.

N70-36774*# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
DETERMINATION OF WELDABILITY AND ELEVATED TEMPERATURE STABILITY OF REFRACTORY METAL ALLOYS. 1: WELDABILITY OF REFRACTORY METAL ALLOYS
G. G. Lessmann Washington NASA Aug. 1970 292 p refs
(Contract NAS3-2540)
(NASA-CR-1607; WANL-PR-(P)-013) Avail: CFSTI CSCL 11F

Refractory metal alloys commercially available and several experimental alloys were included in this program. Both sheet and plate were welded by GTA (gas-tungsten-arc) and EB (electron beam) weld processes. Tantalum alloys showed excellent weldability, followed by the columbium alloy which showed variable weldability, followed by the tungsten alloys which showed generally poor weldability. Weldability was interpreted in terms of its effect on mechanical and metallurgical characteristics rather than merely the ease of joining. Reliable methods were developed for control of the weld atmosphere. A statistical sampling showed that the refractory metal alloys can be welded without contamination. The factors causing weld porosity were determined and procedures to eliminate it were developed to avoid it. The importance of balance between matrix and grain boundary strength in high temperature applications was demonstrated. Alloys with large weld grains (solid solution alloys), low recrystallization temperatures, and relatively weak grain boundaries (yttrium modified alloys) had the least desirable tensile fracture characteristics. Author

N70-36952# British Iron and Steel Research Association, London (England). Metallurgy Div.
AN INVESTIGATION INTO SPECIMEN PREPARATION TECHNIQUES SUITABLE FOR SOLID SAMPLES OF HIGHLY ALLOYED MATERIALS
W. Johnson 1968 18 p refs Supersedes MG/DA/632/67 (MG/D/601/68) Avail: CFSTI

Procedures for achieving high accuracy in the results of X-ray fluorescence analysis of highly alloyed materials are considered. A range of high-alloy steels were investigated to measure precisely the error attributable to specimen preparation under various conditions. The tests show that 28% Ni steel and 18/8 stainless steel are free from any measuarble segregation; the 18/4/1 + 5% Co high-speed steel and the 12% Cr 2% C die steel are probably free from segregation, but the X-ray response was sensitive to minor differences in the mirror-finish surface; the cast 18/4/1 high-speed steel shows some slight effects which might be caused by segregation or by the mirror polishing preparation technique; and the cast bars of nickel, cobalt, and iron based material shows marked segregation, particularly for the carbide-forming elements tungsten and molybdenum. On the basis of the tests, recommendations are made for further improvement in specimen preparation. R.B.

N70-36976# Cornell Univ., Ithaca, N.Y. Dept. of Materials Science and Engineering.
DEFECTS IN METAL CRYSTALS Annual Progress Report, 1 May 1969 – 30 Apr 1970
R. W. Balluffi and D. N. Seidman 13 Mar. 1970 30 p refs
(Contract AT(30-1)-3504)
(NYO-3504-46) Avail: CFSTI

The objective of the present research effort was a broad investigation of the basic properties of defects in metal crystals. Attention was focused on point defects (vacancies, interstitials, and solute atoms), line defects (dislocations), and planar defects (dislocation arrays, grain boundaries and surfaces). Progress was made in the following areas: defects observed by electron microscopy in silver bombarded with silver ions; annealing kinetics of vacancy defects in quenched gold at elevated temperatures; rapid self-diffusion along dislocations in aluminum; electron microscopy study of low and high angle grain boundaries in gold; field ion microscopy of gold; an in situ field ion microscopy study of Stage I recovery of tungsten irradiated with 20 KeV tungsten ions; study of vacancy defects in quenched platinum via field ion microscopy and electrical resistivity measurements; study of displacement spikes in irradiated tungsten; an in situ field ion microscope study of Stage I of platinum irradiated with platinum ions; and construction of field ion microscope equipment. Author (NSA)

N70-36977# State Univ. of New York, Stony Brook.
FATIGUE-ENHANCEMENT OF DIFFUSION Progress Report, 1 Jun. 1969 – 31 May 1970
Herbert Herman 31 May 1970 15 p refs
(Contract AT(30-1)-4097)
(NYO-4097-1) Avail: CFSTI

Fatigue-enhancement of diffusion was studied in alpha-brass in the disordered condition. Diffusion in this alloy occurred by a vacancy mechanism, and when the disordered alloy was irradiated at ambient temperatures, the resistivity was seen to decrease, implying the generation of vacancies which were able to aid diffusion. Such, too, was the case for low-amplitude cyclic straining. The temperature dependency was different than for the irradiation experiments, yet the results were qualitatively similar. Recent work was aimed at elucidating a frequency and amplitude effect in cyclic straining. In addition, alpha-brass was cycled at the temperature of liquid nitrogen, followed by isochronal annealing. A study is currently underway to characterize the process which is giving rise to enhanced ordering in this latter experiment. Enhanced diffusion during cyclic straining represented the fatigue-assisted breakdown of a metastable condition (the initially disordered alloy), and therefore has important fundamental and technological implications. Author (NSA)

N70-37009# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
STUDY OF THE INTERACTION OF A BERYLLIUM WIRE AND AN ALUMINIUM MATRIX [ETUDE DE L'INTERACTION ENTRE UN FIL DE BERYLLIUM ET UNE MATRICE ALUMINIUM]
Jean-Pierre Trottier and Rene Graf 1970 10 p refs In FRENCH; ENGLISH summary Presented at the AGARD Intern. Symp. on Composite Mater., Paris, 2 – 3 Apr. 1970 Submitted for publication Sponsored by Direc. des Rech. et Moyens d'Essais
(ONERA-TP-798) Avail: CFSTI

Nickel-plated beryllium wires were covered by electrolytic aluminium coatings, with or without removal of the nickel layers. Diffusion phenomena were studied by X-ray diffraction, scanning microscope examination, and microprobe analysis, after a series of thermal treatments of variable duration at 250, 480, and 600 C. The recrystallization states of the wires and the matrices were observed by X-rays. The sample structures did not undergo any noticeable modifications at 250 C or during short treatments at 480 C. Author (ESRO)

N70-37044*# Lehigh Univ., Bethlehem, Pa. Dept. of Metallurgy and Materials Science.
THE MONOTONIC AND CYCLIC MECHANICAL RESPONSE

OF THE Ni-Ni3Nb EUTECTIC COMPOSITE
William R. Hoover (Ph.D. Thesis) 1970 68 p refs
(Grant NGR-39-007-007)
(NASA-CR-112772) Avail: CFSTI CSCL 11F

The static and dynamic mechanical behavior of the Ni-Ni3Nb eutectic composite was studied with tensile, compressive, and fatigue testing, and metallography and electron fractography. A study of the deformation and fracture behavior of the Ni3Nb phase was also conducted. The Ni3Nb phase was found to deform primarily by twinning with little or no slip. Room temperature tensile testing of the eutectic composite produced uniform tensile strains in excess of 11%. Tension-tension fatigue studies of the eutectic alloy were conducted. The composite displayed excellent fatigue resistance in a notched configuration by exhibiting an apparent endurance limit of about 55% of the 108 ksi smooth bar tensile strength. The fatigue behavior of the Ni-Ni3Nb eutectic composite was compared with that of Al-Al3Ni eutectic composite, and similar operative crack growth mechanisms were found. Author

N70-37075# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
STRUCTURE AND PROPERTIES OF UNIDIRECTIONALLY SOLIDIFIED SUPERALLOYS [STRUCTURE ET PROPRIETES DES SUPERALLIAGES A CRISTALLISATION ORIENTEE]
Herve Bibring 1970 10 p refs In FRENCH; ENGLISH summary
Presented at the AGARD Meeting on Advanced Technol. for Construction of Aerospace Engines, London, 6–10 Apr. 1970 Submitted for publication
(ONERA-TP-795) Avail: CFSTI

Unidirectional solidification is described and its application to superalloys, especially the production of turbine blades and vanes, is discussed. Unidirectionally solidified parts display elongated grains lying parallel to the solidification axis. In nickel or cobalt based superalloys with face centered cubic structure, the grains have a preferential crystallographic orientation along the (001) cube edge, and there are no transverse grain boundaries. Ductility along the solidification axis is improved at all temperatures and the time of rupture on creep is enhanced. Tensile and creep tests performed normally to the growth direction give results similar to those of conventional cast alloys. The absence of transverse grain boundaries favours hot corrosion coating. Unidirectional casting will be suitable for high strength superalloys with a low chromium content which are usually brittle and difficult to protect against corrosion. Author (ESRO)

N70-37090*# Aeronutronic, Newport Beach, Calif.
DEVELOPMENT AND METALLURGY STUDY OF A NASA COBALT-BASE SUPERALLOY Final Report
R. A. Harlow and E. Gold 15 Apr. 1970 49 p refs
(Contract NAS3-12421)
(NASA-CR-72726) Avail: CFSTI CSCL 11F

VM-103, previously a Co-25W-3Cr-1Ti-0.5Zr-0.5C research laboratory superalloy, was further advanced by developing forging, hot rolling, and cold rolling parameters for fabrication of 25-50 lb. (11-23 kg) ingots produced by induction plus vacuum arc remelting and induction plus electroslag remelting. Electroslag remelted VM-103 proved superior in respect to strength, ductility, and fabricability. Aging studies showed significant hardening effects on prior annealed and prior cold-worked material. The 2200 F yield strength was increased by 140% by aging prior annealed material. The fabrication studies, conventional and high strain rate tensile tests, fatigue tests, and bend tests indicated that VAR-103 is competitive with conventional superalloys, particularly for short time high temperature applications. Author

N70-37095# California Univ., Berkeley. Lawrence Radiation Lab.
INTERSTITIAL ORDERING AND MECHANICAL PROPERTIES OF TANTALUM-CARBON ALLOYS
Prakash Rao (Ph.D. Thesis) Dec. 1969 120 p refs
(Contract W-7405-eng-48)
(UCRL-19113) Avail: CFSTI

Direct evidence for interstitial ordering in the tantalum–carbon system was obtained by transmission electron microscopy and field ion microscopy and was correlated with data on mechanical properties. Transmission electron microscopy indicated that the ordering transformation begins by fine scale fluctuations in carbon composition associated with the (110) planes. The fully ordered structure was realized locally when regions of ideal wavelength were obtained. The alloy can be considered then to contain small ordered particles. These small ordered regions align themselves along (110) and grow until impingement. The final stage of the ordering transformation occurred with the formation of long range highly ordered regions separated by coherent domain boundaries. At this stage the alloys became totally brittle. Analyses of electron diffraction patterns of the ordered phase showed that at the critical carbon composition the structure of the ordered phase corresponded to body centered tetragonal Ta64C. Author (NSA)

N70-37100# Atomics International, Canoga Park, Calif.
EFFECT OF HELIUM ON STRESS-RUPTURE BEHAVIOR OF TYPES 304 AND 316 STAINLESS STEELS
K. R. Garr, D. Kramer, and C. G. Rhodes 15 Apr. 1970 28 p refs
(Contract AT(40-3)-701)
(AI-AEC-12932) Avail: CFSTI

Flat tensile samples of Types 304 and 316 stainless steels, with helium contents of 1.5 × 0.000001 and either 3.5 or 4.0 × 0.00001 atom fraction, were stress-rupture tested in vacuum at 760 C (Type 304) and 700 C (Type 316). The presence of helium caused large reductions in rupture life and in elongation at failure. The amount of strain produced within the grains of helium-containing samples was a small fraction of the measured total elongation. The difference in these values was accounted for by extensive intergranular cracking. Author (NSA)

N70-37145# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Festkoerper und Neutronenphysik.
MEASUREMENT OF THE STORED ENERGY IN ELECTRON IRRADIATED PLATINUM UNDER 40 K MESSUNG DER GESPEICHERTEN ENERGIE AN ELEKTRONENBESTRAHLTEM PLATIN UNTERHALB 40 K]
Klaus Feese (Ph.D. Thesis–Tech. Hochschule Aachen) Apr. 1970 51 p refs In GERMAN
(Jul-658-FN) Avail: CFSTI

Heat measurements were carried out on platinum, after irradiation with 3 MeV electrons produced by a Van de Graaff generator, at temperatures under 10 K. The energy released by the annealing of the radiation-induced Frenkel pairs was measured between 15 and 40 K. ESRO

N70-37155# Iowa State Univ. of Science and Technology, Ames.
INTERNAL OXIDATION AND OXIDES OF A VANADIUM-15 TITANIUM-7.5 CHROMIUM ALLOY
Darrel R. Duncan, William L. Larsen, and Frank X. Kayser Aug. 1969 51 p refs
(Contract W-7405-eng-82)
(IS-2151) Avail: CFSTI

Sheet samples of V-15 Ti-7.5 Cr alloy were charged with oxygen by oxidizing under a reduced pressure of oxygen in the temperature range 850 to 1020 C and annealing in vacuum between 750 and 950 C. The resulting alloys were examined by metallography, X-ray diffraction, microprobe and microhardness. As annealing temperatures were increased the inner hardened zones disappeared and a uniformly distributed oxide was observed. This oxide was identified as (Ti,V)2O3 solid solution. Titanium diffused outward from the unaffected core of the alloy toward the advancing

oxygen front, where it precipitated internally as (TiV)2O3. In the most highly oxidized surface zones, all the available titanium was extracted from the alloy leaving a binary vanadium–chromium alloy matrix. Chromium apparently did not participate in the oxidation reaction to any significant degree. Author (NSA)

N70-37310# Stanford Univ., Calif.
APPLICATION OF CONTROLLED ELECTROMAGNETIC FORCES DURING SOLIDIFICATION OF TYPE 304 STAINLESS STEEL Quarterly Report, 1 Dec. 1969–1 Mar. 1970
William A. Tiller 1 Mar. 1970 6 p
(Contract AT(04-3)-326)
(PB-191591; SU-326-P29-3; QR-3) Avail: CFSTI CSCL 13H

Progress is reported for the following areas of an investigation of the effects of application of controlled electromagnetic forces to stainless steel melts during solidification: Grain refinement; undercooling; scale-up; metallographic studies. USGRDR

N70-37385*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TESTS OF EVALUATED BERYLLIUM (n,2n) CROSS SECTIONS BY ANALYSIS OF 1.4-eV FLUX IN WATER FOR AN AMERICIUM-BERYLLIUM SOURCE ENCLOSED IN BERYLLIUM SPHERES
Daniel Fieno, Roger L. Alexander, and C. Hubbard Ford Washington Sep. 1970 40 p refs
(NASA-TN-D-5995; E-5444) Avail: CFSTI CSCL 11F

Measurements in water of the neutron flux distributions at indium resonance energy, with Be shells enclosing an Am-Be neutron source, were made to quantitatively test two evaluated sets of (n,2n) cross sections for Be-9. Transport theory calculations of the experimental flux distributions were made using cross sections from these two evaluations of the decay modes of the Be-9(n,2n) reaction. The first evaluation is based on the cross section program GAM-II in which the data files are based on the same cross section evaluation employed for the current ENDF/B library for Be. The second evaluation is based on Perkins' detailed studies of the reactions which contribute to the Be(n,2n) cross section. Calculations using GAM-II data were in poor agreement with the present experiments, whereas calculations using Perkins' data were in good agreement. Author

N70-37431# Bureau of Mines, Albany, Oreg. Metallurgy Research Center.
MELTING OF TUNGSTEN IN A VACUUM ARC FURNACE WITH A CONSUMABLE ELECTRODE
G. H. Vasyukov et al 1969 16 p Transl. into ENGLISH from Fiz. i. Khim. Obrabotki Mater. (USSR), no. 1, 1969 p 51–57
(PB-190083T) Avail: CFSTI CSCL 11F

Investigated were the dependence of the rate of melting consumable tungsten electrodes on residual pressure in the zone of the arc, on the current strength in the arc, and diameters of electrodes, during melting with straight polarity and with alternating current. It was established that melting of consumable tungsten electrodes with straight polarity is possible only in the presence of boiling baths of tungsten, that is, if the residual pressure in the arc zone is not higher than the saturation vapor pressure of molten tungsten for a given bath temperature. Author (USGRDR)

N70-37434# Kentucky Univ., Lexington. Coll. of Engineering.
AVOIDANCE OF SOFTENING IN DILUTE ALLOYS OF COPPER CONTAINING HEXAGONAL SOLUTE ADDITIONS,1969–1970
Charles E. Sohl and Robert J. de Angelis 4 May 1970 45 p refs Supported by Intern. Copper Res. Assoc., New York
(PB-191852; TR-24-70-MET-11) Avail: CFSTI CSCL 11F

Parameters describing the softening process were to be evaluated employing X-ray and electron diffraction metallographic techniques and mechanical property determinations are presented. Included are: (1) a substructural description of the plastically deformed state of Cu-Zr-Mg alloy; (2) a description of changes in substructure observed on annealing a Cu-Zr-Mg alloy in the temperature range of 450 to 600C; and (3) a collection of abstracts of significant literature. A softening mechanism involving the formation of coincident boundaries is proposed which is in agreement with the experimental observations. Author (USGRDR)

N70-37478# Michigan Univ., Ann Arbor. Cavitation and Multiphase Flow Lab.
ASTM ROUND ROBIN TEST WITH VIBRATORY CAVITATION AND LIQUID IMPACT FACILITIES OF 6061T 6511 ALUMINUM ALLOY, 316 STAINLESS STEEL COMMERCIALLY PURE NICKEL Final Report
F. G. Hammitt, C. Chao, C. K. Kling, T. M. Mitchell, and D. O. Rogers Dec. 1969 63 p refs
(Grant NSF GK-1889)
(PB-189112; MMPP-344-3-T-Mod; Rept-01357-4-T) Avail: CFSTI CSCL 11F

A test program was conducted to study the differences, or similarities, in cavitation or impingement damage data obtained by twelve laboratories using ostensibly the same procedures and testing the same materials. The data from the reporting laboratories are represented on various damage or damage rate vs. time curves. Although all the laboratories rank the materials in the same order, when data on one material from different laboratories are plotted together, a very substantial spread is found. Detailed examination of the test procedures indicate differences in those procedures are largely responsible for significant differences in test results. Author (USGRDR)

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N70-36204# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
SIGNIFICANT PROPERTIES OF PRESSURE COMPENSATING LIQUIDS FOR DEEP OCEAN APPLICATIONS
A. S. Hamamoto, G. C. Knollman, and D. O. Miles Dec. 1969 40 p refs
(AD-701057; LMSC-6-F2-69-1) Avail: CFSTI CSCL 11/8

Physical and electrical properties of Dow Corning 200 silicone oil (kinematic viscosity of 5 centistokes) are presented over wide temperature and pressure ranges. Comparisons are made between the physical properties of this liquid and those arising when this liquid is mixed with carbon tetrachloride. The effects of carbon tetrachloride on the physical properties of the silicone fluid are discussed with reference to friction-wear enhancement of the marginal lubrication capabilities associated with the silicone oil alone. Author (TAB)

N70-36225# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ANALYTICAL METHOD FOR DETERMINING THE SERVICE LIFE OF OIL IN AN ENGINE
V. N. Sukharnikov et al 20 Feb. 1970 11 p refs Transl. into ENGLISH from Samoletostroenie i Tekhn. Vozdushnogo Flota

(USSR), no. 13, 1968 p 132–136
(AD-703999; FTD-HT-23-860-69) Avail: CFSTI CSCL 11/8

A method, based on theoretical considerations and experimental data, is suggested for determining the service time of a lubricant in any aircraft engine. The study includes numerous equations e.g.: formula for determining the processes of oxidation in relation to various operational elements of the engine and properties of lubrication oil; a formula for determining engine wear in relation to its parameters and lube oil properties; a formula for determining the content of inorganic admixtures in the lube oil; and a formula for determining engine wear as affected by the inorganic admixtures in the lube oil. TAB

N70-36228# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INCREASING THE WEAR RESISTANCE OF RUBBER PARTS BY FLUORINATION OF THEIR SURFACE
A. N. Nudelman et al 20 Feb. 1970 8 p refs Transl. into ENGLISH from Kauchuk i Rezina (Leningrad), v. 28, no. 3, 1969 p 21–23
(AD-704004; FTD-HT-23-100-70) Avail: CFSTI CSCL 11/10

The report presents the results of studies on the effect of antimony pentafluoride on the wear resistance of butadiene nitrile rubber. Fluorination was accomplished by two methods without preliminary chlorination of the rubber surface: with antimony pentafluoride liquid and vapor. The method of vapor phase fluorination for the rubbers surface is recommended for industrial purposes. TAB

N70-36231 National Lending Library for Science and Technology, Boston Spa (England).
INTERNAL STRUCTURE OF GRAPHITE GRAIN, OBTAINED IN CAST IRON BY OXIDATION ETCHING METHOD: OBSERVED BY ELECTRON MICROSCOPE
Shigeji Hagiwara et al 8 Apr. 1970 6 p refs Transl. into ENGLISH from Japanese journal
(NLL-M-9062-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

Methods of preparing specimen surfaces for investigation under the electron microscope are described. Various graphite-based materials in combination with a liquid oxidizing agent were used. Photographs are presented to illustrate the internal structure of the prepared graphite materials. R.B.

N70-36247# Chemical Systems, Inc., Santa Ana, Calif.
HEAT RESISTANT POLYMERS CONTAINING THE LOW MOLECULAR WEIGHT CLOSO-CARBORANES. 1: POLYCARBORANYLENESILOXANE Sib-1 ELASTOMERS FROM C2B5H7
Robert E. Kesting, Kenneth F. Jackson, Eugene B. Klusman, and Francis J. Gerhart 24 Mar. 1970 19 p refs Submitted for publication
(Contract N00014-70-C-0109)
(AD-704812; TR-2) Avail: CFSTI CSCL 7/2

Elastomeric carboranesiloxane polymers of the Sib-1 type have been prepared from C2B5 analogs of C2B10 by sterically inhibiting crystallite formation via the introduction of an occasional C2B8 or C2B10 moiety. Crystallization of the modified Sib-1 polymers on standing was prevented by the introduction of covalent crosslinks. Author (TAB)

N70-36280# Oak Ridge National Lab., Tenn.
AGING, WEATHERING, AND POISONING OF IMPREGNATED CHARCOALS USED FOR TRAPPING RADIOIODINE
R. D. Ackley, Zell Combs, and R. E. Adams Mar. 1970 21 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2860) Avail: CFSTI

Aging, weathering (exposure to flowing air), and poisoning are processes which might adversely affect charcoal performance, especially with regard to trapping radioiodine in the form of methyl iodide (CH_3I). Accordingly, some effort has been applied toward investigating the effects of the above processes. The bulk of the data obtained corresponds to four different types of charcoal. Three types are iodized, thus providing isotopic exchange capability, and the other is triethylenediamine-impregnated. The influences of the processes were examined by observing the variation in I-131 of CH_3(I-131) removal capability for the iodized charcoals or in CH_3I removal capability for the amine-impregnated charcoal. The results, which were generally in accord with expectation, indicated that aging per se has little or no effect on impregnated charcoal performance; weathering with air at around 50% relative humidity has an appreciable effect; and poisoning of iodized charcoal can have a large effect. Author (NSA)

N70-36282 National Lending Library for Science and Technology, Boston Spa (England).
PREPARATION AND PROPERTIES OF ACRYLIC FIBRES MODIFIED WITH CHLORINE. PART 1: MODACRYLIC FIBRES BASED ON A BINARY COPOLYMER OF ACRYLONITRILE AND VINYL CHLORIDE
W. Berger et al 24 Jun. 1970 12 p refs Transl. into ENGLISH from Faserforsch., v. 20, 1969 p 467–472
(NLL-M-9192-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

The relationship between spinning conditions and fiber properties was investigated with acetone-soluble acrylonitrile/vinylchloride copolymers obtained on a small scale by the emulsion method (redox system). Author

N70-36286# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
USE OF PLASTIC MATERIALS FOR SEALING AND SLIDING BEARINGS IN MACHINES
G. A. Gorokhovskii et al 16 Jan. 1970 26 p refs Transl. into ENGLISH from the Russian
(AD-704191; FTD-MT-24-324-69) Avail: CFSTI CSCL 11/8

Contents: Surface activity of polymers and its effect on the wear of metals; and the Search for optimum fillers as antifriction plastics with a Teflon-4 base. TAB

N70-36287# Air Force System Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ANTIFRICTION PROPERTIES OF SOLID LUBRICANT COATINGS IN AN INERT GAS ATMOSPHERE AND IN VACUUM
R. M. Matveevskii et al 30 Jan. 1970 18 p refs Transl. into ENGLISH from Trenie i Iznos v Mashinakh, Akad. Nauk SSSR, Inst. Mashinoved. Sb. (Moscow), no. 20, 1968 p 168–177
(AD-704188; FTD-HT-23-659-69) Avail: CFSTI CSCL 11/8

Stainless steel surfaces of an apparatus for measuring the coefficient of friction were coated with solid lubricants prepared from mixtures of disulfide and poly resin or Na silicate. TAB

N70-36288# Rhode Island Univ., Kingston. Div. of Engineering Research and Development.
MATERIAL REMOVAL PHENOMENA IN CERAMICS Final Technical Report, 15 Nov. 1968–15 Nov. 1969
Peter J. Gielisse and Joseph Stanislao Dec. 1969 57 p refs
(Contract N00019-69-C-0131)
(AD-704611) Avail: CFSTI CSCL 13/8

An experimental set up for evaluation of the dynamic and thermal aspects of the stock removal phenomena with a single-point

diamond on a variety of alumina ceramics is presented. The experimental design and problem approach of the single-point cutting tool experiments have been conceived so as to facilitate the development of a relationship between process parameters and the physical characteristics of the workpiece in ceramic finishing. Experimental results in terms of the dynamic and thermal data obtained are presented. Preliminary results indicate a need for the development of criteria for the evaluation of fracture phenomena in ceramics under dynamic loading conditions. A distinct difference, in terms of force relations and temperatures generated, was found between the four types of aluminas investigated. Author (TAB)

N70-36294# Oak Ridge National Lab., Tenn.
THEORY OF CRACK PROPAGATION DURING TENSION-TENSION FATIGUE IN A MATERIAL EXHIBITING TIME-DEPENDENT PLASTICITY
John Gittus Mar. 1970 13 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2857) Avail: CFSTI

A set of differential equations describing the process of time-dependent crack propagation during tension-tension fatigue was developed. The model of crack extension is that developed by Tomkins, which hypothesizes that plastic deformation in zones ahead of the fatigue crack leads to further loss of cohesion. Therefore, the rate of crack growth depends on the rate of deformation in the plastic zones and on their size. Their size depends on the stress, while the rate of deformation is calculated from equations for time-dependent plastic deformation in a material containing dislocations that are immobilized and remobilized by reactions whose rates depend on stress and temperature. Author (NSA)

N70-36300# IIT Research Inst., Chicago, Ill.
FIBER OPTICS WITH EXTENDED ULTRAVIOLET TRANSMISSION Triannual Report, 1 Sep.–31 Dec. 1969
M. A. Ali, A. G. Pincus, and M. A. Schwartz Apr. 1970 25 p refs
(Contract DAAB07-67-C-0542)
(AD-704322; ECOM-0542-7; Rept-7) Avail: CFSTI CSCL 11/2

The objective of this contract is to conduct research and development leading to the fabrication of fiber optic faceplates for cathode ray tubes with high transmission in the near and middle ultraviolet regions. During this period, clad fibers were drawn from the scaled-up meltings of core and clad glasses. Also, a detailed procedure for scaled-up melting was prepared which could be adapted to large scale melting in the fabrication of 5-in. faceplates. Work on compositional adjustment of the clad glass (157K-5) was initiated to develop a clad glass having a lower coefficient of thermal expansion than the core glass (25AT). Author (TAB)

N70-36373 National Lending Library for Science and Technology, Boston Spa (England).
STRENGTHENING LAVSAN FILAMENTS BY EXTRUSION DRAWING
V. E. Heller et al 24 Jun. 1970 6 p refs Transl. into ENGLISH from Mekh. Polim. (Latvian SSR), v. 1, 1967 p 172–179
(NLL-M-9218-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy couponis

Two methods, drawing godets rotating at different speeds, and extrusion, drawing filaments through jet channels, were compared. Of the two methods the latter shows a higher tenacity. This phenomenon was investigated using the thermochemical method and etching with sulfuric acid. Experimental results suggest that the increase in strength is due to the density of the surface layer. Author

N70-36400* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
BONDED SOLID LUBRICANT COATING Patent
Harold E. Sliney, inventor (to NASA) Issued 17 Nov. 1964 (Filed 13 Oct. 1961) 6 p Cl. 117-69
(NASA-Case-XMS-00259; US-Patent-3,157,529; US-Patent-Appl-SN-145007) Avail: US Patent Office CSCL 11H

An invention is presented concerning bonded solid film lubricants which maintain their lubrication qualities under conditions of extreme heat and varying oxygen partial pressures, with special applicability to reentry vehicle usage. A lubricant coated article is described comprised of a base to which is bonded a coating composition of calcium fluoride and a binder. The requirements for the binder are discussed, and the application of the coating considered. Examples of the invention are given, and methods of improving their quality are listed. P.A.B.

N70-36403# General Dynamics/Convair, San Diego, Calif.
HATCH SEALING TESTS
W. R. Hoover Oct. 1969 24 p refs
(Contract Nonr-3062(00)
(AD-704533; GDC-AAX70-012) Avail: CFSTI CSCL 13/10

The purpose of conducting the buoy hatch sealing tests was to establish a technique suitable for field use that will provide adequate environmental sealing of the hatches, avoid damage to the seals, and assure long-term watertight integrity of the hatch seal. Author (TAB)

N70-36432# Israel Inst. of Tech., Haifa. Dept. of Materials Engineering.
EXPERIMENTS ON THE DYNAMIC TENSILE STRENGTH OF METALS AND PLASTICS
Baruch Revsin and Sol R. Bodner Sep. 1969 41 p refs
(Contracts F61052-69-C-0042; AF 61(052)-951)
(AD-698360; SR-3; Rept-21) Avail: CFSTI CSCL 14/2

A drop weight test machine was developed which can subject specimens to tensile strain rates of 50/sec. Dynamic and static tensile stress-strain curves were obtained for commercially pure aluminum, high purity aluminum, alpha-brass, and an epoxy resin. The results showed that all these materials are rate sensitive in that the dynamic curves differed significantly from the static ones. The results are discussed in relation to those obtained by other investigators. Author (TAB)

N70-36542# Stevens Inst. of Tech., Hoboken, N.J. Dept. of Chemistry and Chemical Engineering.
THERMOMECHANICAL STUDIES OF POLYMER DEFORMATION. 2: A THERMODYNAMIC ANALYSIS OF A VISCOELASTIC MATERIAL IN SINUSOIDAL DEFORMATION
I. J. Duvdevani, J. A. Biesenberger, and C. G. Gogos Feb. 1970 29 p refs
(Contract N00014-68-A-0131)
(AD-704818; TR-14) Avail: CFSTI CSCL 11/9

A linearly viscoelastic polyurethane film was subjected to steady, sinusoidal deformation in a new isothermal deformation calorimeter, whose design details were recently reported. Internal energy and entropy of the polymer at each state in the deformation cycle were computed from heat rate and work rate data. This was made possible by using linear viscoelasticity theory to predict the irreversible entropy production. Thermal data were corrected for instrument time lag. Author (TAB)

N70-36591*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AIR PERMEABILITY STUDIES OF A LIGHTWEIGHT COATED FABRIC SUBJECTED TO UNIAXIAL TENSILE LOADS WITH AND WITHOUT PRIOR CYCLING

Jerry W. Deaton Washington Aug. 1970 23 p refs (NASA-TN-D-5931; L-6997) Avail: CFSTI CSCL 11E

The air permeability of a particular lightweight fluorocarbon rubber-coated high-temperature nylon fabric as determined experimentally from strip specimens at room temperature while subjected to uniaxial tension are presented and discussed. Strip specimens were load cycled at 0.25, 0.50, and 0.75 of the fabric strength for 10 and 100 cycles for comparison with the air permeability obtained during the initial loading of similar specimens. The results demonstrate that, for this coated fabric, the coating remains effective up to about 0.90 of the ultimate fabric strength for the initial tensile loading. However, the coating becomes ineffective for the specimens subjected to cyclic tensile loads and the resulting air permeability was found to be dependent on both the magnitude of the cyclic load and the number of loading cycles. Author

N70-36694*# Perkin-Elmer Corp., Norwalk, Conn.
MATERIALS CONSIDERATIONS FOR LARGE SPACEBORNE ASTRONOMICAL TELESCOPE
John B. Schroeder *In* NASA, Washington Opt. Telescope Technol. 1970 p 141–148 (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 11B

A large primary mirror will efficiently focus radiation with wavelengths between approximately 40 nanometers and 1 meter and provide a dynamic range of over 10,000,000. Since weight must be kept to a minimum and launch stress deformation of the telescope must be avoided, pertinent physical properties of mirror materials must be considered for their stiffness-to-weight ratio. Model mirror material weights for several materials are shown in table form as a function of maximum tensile stress during a 30-g launch. The model mirror used in the calculations is flat, 1-meter in diameter, and supported uniformly about its perimeter. This model illustrates the trade-offs between microyield strength, density, and weight and shows that lightweight structures may be employed to increase stiffness during manufacture. Candidate materials developed are: beryllium, silicon, and fused silica. G.G.

N70-36700*# General Electric Co., New York.
PORE-FREE CERAMICS MADE BY SINTERING
J. E. Burke *In* NASA, Washington Opt. Telescope Technol. 1970 p 189–190 (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 11B

Described are two single-phase pore-free ceramics that might offer advantages as a mirror material under conditions where their special properties would outweigh their disadvantages. Lucalox aluminum oxide ceramic is made by conventional ceramic-processing techniques from high purity aluminum oxide powder with the addition of about 0.1 weight percent magnesium oxide. The product is a pore-free, polycrystalline material having properties substantially the same as sapphire. Yttralox is a material of similar microstructure, also made by cold pressing and sintering from yttrium oxide powder with the addition of several percent of thorium oxide. It is conceivable that Lucalox and Yttralox might be useful for astronomical mirrors in which high rigidity would outweigh the disadvantages of a relatively high coefficient of expansion. Author

N70-36701*# General Electric Co., New York.
DIMENSIONAL CHANGES IN GLASS AT ROOM TEMPERATURE
J. E. Burke *In* NASA, Washington Opt. Telescope Technol. 1970 p 191–192 (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 11B

Stress induced ionic movements produce analytic distortions in the surface of glass mirrors of large dimensions. The stress applied to the mobile ionic system of sodium in glass reduces free energy when the ions move into the region of tension from the region of compression and thus build up a space charge until a steady state composition gradient is reached. Gradual relaxation to the original configuration occurs at a rate controlled by the diffusion coefficient of the mobile species. Permissible residual stress levels in a mirror blank should be related to the composition of the glass in regard to its mobile ion component; stressed regions in polished glasses with no highly mobile ions in it relax in a very short time constant and thus can accept relatively large residual stresses. G.G.

N70-36702*# Corning Glass Works, N.Y.
ULE TITANIUM SILICATE FOR MIRRORS
Charles F. de Voe *In* NASA, Washington Opt. Telescope Technol. 1970 p 195–199 (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 11B

The great similarity of structure between ULE titanium silicate and fused silica adds all of the advantages of fused silica to the very low thermal expansion of ULE to make it an ideal mirror material. The fact that this material can be fused with a flame or in a furnace without destroying the near-zero expansion makes possible the construction of any mirror size required. Author

N70-36703*# General Electric Co., New York.
MIRROR MATERIALS
Marvin C. Riggert and Robert F. Copper *In* NASA, Washington Opt. Telescope Technol. 1970 p 201–205 refs (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 11B

Important design considerations for high resolution astronomical mirrors are: (1) thermal stability; (2) thermal expansion; (3) ability to obtain and retain surface finishes; and (4) mechanical characteristics of the material used to fabricate these mirrors. Comparison of fused quartz and Lucalox ceramic (a polycrystalline, fine grain, high purity aluminum oxide material) for their desirable properties in mirror structures show that the latter material has high chemical and thermal stability, high intergranular bond strengths, high strength-to-weight ratios, and is resistant to oxidation and corrosion. Since its density is nearly twice that of fused quartz, but its modulus is 5 1/2 times that of fused quartz, mirror structures could be made with it that have half the thickness of quartz and still maintain greater rigidity. G.G.

N70-36704*# Boeing Co., Seattle, Wash.
SHEAR STRAIN PROPERTIES TO 10 SUP −10 OF SELECTED MIRROR MATERIALS
William A. Eul and W. William Woods *In* NASA, Washington Opt. Telescope Technol. 1970 p 207–212 (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 11B

The optimum procedure for fabricating stable mirrors depends upon establishing the cause of inconsistent microstrain behavior in mirror materials. Heat treatment of the specimens before machining establishes the effects of the machining process; surface etching, polishing, or roughening establishes the role of surface conditioning. Of all materials tested, the viscoelastic recovery rate of heat treated silicas is an order of magnitude faster than in the as-machined state. Heat treated 7940 silica is superior in viscoelastic recovery rate to either the ULE silica or the Cer-Vit. G.G.

N70-36779# Picatinny Arsenal, Dover, N.J. Materials Engineering Lab.
RELATION BETWEEN THE TENSILE MODULUS AND THE FAILURE TIME OF GLASS-FILLED NYLONS
Elise McAbee and David W. Levi May 1970 23 p refs (AD-705372; PA-TM-1917) Avail: CFSTI CSCL 11/4

The object of this study was to determine whether the failure times of glass-filled nylons can be related to their tensile moduli. Author (TAB)

N70-36868# National Engineering Lab., Glasgow (Scotland). Materials Group.
CREEP RUPTURE AND TENSILE TESTS ON GLASS-REINFORCED LAMINATES
W. S. Carswell, D. L. Latham, and E. S. Tweedie Nov. 1969 29 p refs
(NEL-439) Copyright. Avail: CFSTI

Tensile and creep rupture tests were carried out at room temperature on polyester and epoxy laminates reinforced with two types of glass cloth, and at elevated temperatures on the polyester laminates reinforced with satin weave cloth. Damage, as seen by optical microscopy, appeared to be confined to isolated regions of delamination between glass and resin until first failure of the reinforcement produced localized resin cracking. A relationship is shown to exist between the tensile and creep rupture properties of a given laminate. This relation is discussed on the assumption that failure is due primarily to the time-dependent failure of the glass filaments. Author

N70-36888*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Engineering Mechanics Div.
MATERIALS
In its Space Programs Sum. No. 37-62, Vol. 3 30 Apr. 1970 p 176-180 (See N70-36876 20-34)
Copyright. Avail: CFSTI CSCL 11G

Approaches to solving the antenna mesh problem for the thermoelectric outer planet spacecraft are investigated. Developments associated with antenna ribs and central hub are being examined. A calorimeter for measuring the thermal properties of multilayer insulation was designed, constructed, and placed in operation. From an energy balance of the power required to maintain a specified inner wall temperature while radiating to a liquid nitrogen cold wall, a value of effective emittance for the insulation was determined. A preliminary study on the noncondensible gas formation in water/metal heat pipes was also performed. J.A.M.

N70-36895*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Propulsion Div.
POLYMER RESEARCH
In its Space Programs Sum. No. 37-62, Vol. 3 30 Apr. 1970 p 235-244 refs (See N70-36876 20-34)
Copyright. Avail: CFSTI CSCL 11I

The kinetics of the formation of high charge density ionene polymers were investigated. The rates of polymerization of 3, 4-ionene versus solvent composition are plotted. It is concluded that the polymerization reaction obeys the second order kinetics in several solvents at relatively high concentration. F.O.S.

N70-36973# State Inst. for Technical Research, Helsinki (Finland).
MEASUREMENTS OF PORE SIZE DISTRIBUTION OF POROUS MATERIALS
Tenho Sneck and Heikki Oinonen 1970 60 p refs Sponsored by Finnish Technical Research Council
Avail: CFSTI

The porosity measurements of 26 different building materials by mercury penetration and nitrogen adsorption, and of 9 materials by water vapours adsorption is discussed. A commercial mercury porosimeter was used with mercury entering the pores of the sample by means of pressure. The penetrated amount of mercury is directly proportional with the pore volume in every pressure range. A commercial nitrogen analyzer was used, in which a mixture of nitrogen and helium flows through the sample at the temperature of liquid nitrogen. The nitrogen amount adsorbed was measured by the change in the thermal conductivity of the gas mixture. The different relative pressures were produced by changing the pressure applied on the sample. For measurements of water vapor adsorption isotherms, an apparatus was constructed which worked on a gravimetric principle. The samples were suspended from calibrated springs and the amount adsorbed water vapor was determined by a cathetometer by measuring the extension of the springs. The relative pressures were produced by salt solutions. Author

N70-37023# Dow Chemical Co., Golden, Colo. Rocky Flats Div.
GLOVEBOX WINDOW MATERIALS
Charles W. Jacoby 13 Mar. 1970 16 p refs
(Contract AT(29-1)-1106)
(RFP-1424) Avail: CFSTI

Coated Plexiglas, Homalite 101B polyester clear transparent sheet, and Zelux W polycarbonate clear transparent sheet have been evaluated and found to have good resistance to detrimental conditions commonly found in plutonium recovery areas. Of these materials, polycarbonate was considered to be the safest and will be the primary plastic window material used in plutonium recovery areas at Rocky Flats. Author (NSA)

N70-37024# Bendix Corp., Kansas City, Mo.
CHARACTERIZATION OF AN EPOXY FOAM
H. M. Mc Ilroy, C. H. Smith [1969] 23 p
(Contract AT(29-1)-613)
(BDX-613-125) Avail: CFSTI

A review of several of the mechanical, electrical, and thermal properties of a one-component rigid epoxy foam system indicates that the foam meets many of the requirements for an embedment material for electronic components. Because of the excellent fluidity, long pot life, and convenient packaging of the premix, many production and processing problems are reduced. The mechanical and electrical properties plus the thermal stability of the cured foam appear to make this epoxy foam a prime candidate for foamed-in-place electronic potting and encapsulation applications. Author (NSA)

N70-37069*# Scientific Translation Service, Santa Barbara, Calif.
DEVELOPMENT AND STUDY OF NEW HEAT-RESISTANT STRUCTURAL MATERIALS
In its The Inst. of High Temp. of the USSR Acad. of Sci. The Most Important Results of Sci. Res. in 1969 Aug. 1970 p 39-44 (See N70-37066 20-33)
Avail: CFSTI CSCL 11B

In a program to develop and study heat resistant structural materials for use in the construction of MHD generators, research conducted includes the following: (1) New technology was developed to obtain lantanium chromite in quantities sufficient for technological use. (2) A study was made of the electrophysical properties of lantanium chromite alloyed with the oxides of the alkali and rare earth metals. (3) Advancements were made in the technology of obtaining electrodes based on chromium carbide alloyed with tungsten and rhenium. (4) An investigation was made of the properties of fire-resistant types of concretes, based on magnesium or aluminum oxides and various high-melting bonding materials. (5) The mechanism and kinetics of the hardening of magnesium cement were studied and the conditions for the formation of the hydrated phases of variable composition were clarified. (6) Models employing high frequency and impulsive plasma heating were used to study the process of obtaining niobium from its compounds in a plasma. D.L.G.

N70-37130# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
COMPTON SCATTERING TECHNIQUE FOR MEASURING THE AREAL DENSITY OF GLASS-REINFORCED STRUCTURES
J. D. White 7 May 1970 20 p refs
(Contract W-7405-eng-26)

(Y-1714) Avail: CFSTI

An investigation has shown the applicability of a new technique for the one-sided nondestructive measurement of the mass uniformity of glass-reinforced laminates. The number of gammas scattered into a detector through 135 degrees by Compton interactions was found to be a smooth function of the mass per unit area of the specimen over a wide range. Author (NSA)

N70-37200# Utah Univ., Salt Lake City. Div. of Materials Science and Engineering.

RECRYSTALLIZATION AND SINTERING OF OXIDES Final Report, Dec. 1961 – Nov. 1969

Ivan B. Cutler 1 Feb. 1970 4 p refs

(Contract AT(11-1)-1122)

(PB-189443; COO-1122-14) Avail: CFSTI CSCL 11B

Related phenomena to sintering and recrystallization of oxides were explored. Strength of partially sintered powder compacts was also examined. Impurity diffusion in non-metallic materials is particularly important in sintering of oxides. Experiments in this area showed that diffusion coefficients are extremely dependent upon impurity concentrations. USGRDR

N70-37244# Forest Products Lab., Madison, Wis.

EXPLORATORY INVESTIGATION OF FIRE-RETARDANT TREATMENTS FOR PARTICLEBOARD

Arthur D. Syska Aug. 1969 34 p refs Prepared in cooperation with Wis. Univ.

(FPL-0201) Avail: CFSTI

Douglas fir and aspen flake-type particleboards made with combinations of common fire-retardant chemicals applied in several ways are evaluated for flammability, mechanical strength, and dimensional stability. Author

N70-37370# United Kingdom Atomic Energy Authority, Harwell (England). Electronics and Applied Physics and Materials Physics Div.

NEUTRON DIFFRACTION STUDY OF CARBON FIBRES

R. N. Sinclair , A. Wedgwood, D. H. C. Harris, and P. A. Egelstaff Jun. 1969 18 p refs

(AERE-R-6052) Avail: AEC Depository Libraries: HMSO: 3s 6d; BIS$0.70

Wide-range data were taken using a time-of-flight diffractometer which exhibited peaks extending from 002 reflections to the 60 band of reflections. The crystal size was determined from the width of the peaks. A set of angular distribution measurements was made on both bundles of fibers and on composites of fibers and resin, using a conventional (fixed wavelength) diffractiometer. These measurements gave the c-axis orientation function of the fibers. Finally, ultra small angle scattering measurements were made to look for defects in the fibers, and these showed the need to correct the data for refraction by a bundle of fibers, the residual effect due to defects being quite small. Author (NSA)

N70-37483*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

A NUMERICAL INTEGRATION SCHEME TO DETERMINE HEMISPHERIC EMITTANCE, SOLAR ABSORPTANCE AND EARTH INFRARED ABSORPTANCE FROM SPECTRAL REFLECTANCE DATA

Donald R. Wilkes 16 Sep. 1969 36 p refs

(NASA-TM-X-53918; MSFC-IN-SSL-T-68-10) Avail: CFSTI CSCL 11C

A numerical method for computing hemispheric emittance, solar absorptance, and earth infrared absorptance from experimentally measured values for the spectral reflectance of a coating is discussed. The results of the method can be programmed on a computer. Author

N70-37481# Bureau of Public Roads, Washington, D.C.

EVALUATION OF PAINTS FOR STRUCTURAL STEEL NORMAL ATMOSPHERE Final Report

David G. Azar May 1969 63 p refs Prepared in cooperation with La. Dept. of Highways

(PB-189336; RR-35) Avail: CFSTI CSCL 11C

The report is the result of a five year program in which various paint systems were studied in an effort to minimize the corrosion problem which exists in Louisiana. This report presents some of the major findings, from a correlated study of field and accelerated exposures. The major emphasis of the study was on the actual correlation of field and accelerated exposures of paint films and evaluating the best paint system studied. Author (USGRDR)

N70-37509*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

A MICROSCOPIC STUDY OF SOLID/LIQUID PHASE CHANGE IN SEVERAL MEMBERS OF THE PARAFFIN FAMILY

Barbara E. Richard and Tommy C. Bannister 16 Sep. 1969 25 p refs

(NASA-TM-X-53917; MSFC-IN-SSL-T-68-9) Avail: CFSTI CSCL 11G

The findings of a preliminary study in which time-lapse movies were taken through a microscope to investigate the solid/liquid interface during phase change is reported. The apparatus, procedure, materials used and results are discussed. Recommendations are made for improvements in technique and equipment. The interface morphology varied greatly during freezing with different materials. All sample materials except water showed microscopic peaks along the interface, but these peak heights varied from a maximum of 0.17 mm for tetradecane to a maximum of 2.25 mm for a binary mixture of 5 percent hexadecane in octadecane. The feasibility of using this technique to study the effects of convection, bubble formation, freezing and melting rates, and other parameters is shown. Author

N70-37527*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

REACTION OF ENCAPSULATING FOAMS TO SPECIFIC ENVIRONMENTAL CONDITIONS

H. M. Walker 12 Sep. 1969 16 p

(NASA-TM-X-53886; MSFC-R-ME-IN-67-9) Avail: CFSTI CSCL 11I

This project was conducted to establish the relative degrees of dimensional stability exhibited by two separate foam systems when exposed to simultaneous thermal cycling. The foam systems under study were mixed and cast into aluminum boxes and compared by one physical characteristic - the vertical, unidirectional expansion of the foam when exposed to incrementally increased temperatures. Author

N70-37532*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

EVALUATION OF POSTSOLDERING CLEANING AGENTS

F. C. Osemiak 9 Sep. 1969 23 p

(NASA-TM-X-53877; MSFC-IN-R-QUAL-67-8) Avail: CFSTI CSCL 11K

The testing results of a selected number of postsoldering cleaning agents are presented with respect to cleaning effectiveness, compatibility with different materials used in printed circuit assemblies, and duration of individual solvent cleaning cycles that could be tolerated without adverse effects and chemical characteristics. The results indicate that the detrimental effects of solvents differ with the composition of the materials used in printed circuit board assemblies. The choice of cleaning agents must be specifically proven for the intended applications. Sampling tests must be performed on assemblies representing the group to be processed to assure compatibility of cleaning solvent and printed circuit assembly material. Author

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N70-36206# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
DUALITY IN LINEAR RANGE-DOMAIN IMPLICATIONS
Johann Schroeder Dec. 1969 23 p refs
(AD-701154; D1-82-0937) Avail: CFSTI CSCL 12/1

The paper is concerned with linear operators M having the property that Mu epsilon C implies u epsilon K, where C and K are given sets. Sufficient conditions for this property have been derived earlier. Here, dual formulations of these sufficient conditions and the property itself are established. The equivalence of the dual and primal conditions is proven for polyhedral sets C and K. Generalizations depend mainly on the availability of appropriate separation theorems. Author (TAB)

N70-36212# Harvard Univ., Cambridge, Mass. Lab. for Computer Graphics and Spatial Analysis.
GEOGRAPHY AND THE PROPERTIES OF SURFACES. A STUDY OF THE MOVEMENT OF A POINT ON A PLANE AND IN SPACE Interim Report
C. Ernesto S. Lindgren 7 Dec. 1969 18 p refs *Its* Papers in Theoret. Geography No. 34
(Contract N00014-67-A-0298)
(AD-704519; ONR-TR-36) Avail: CFSTI CSCL 12/1

The paper discusses a method for determining the path of a point moving on a plane or in space under the influence of more than one field of potential. The method is extended to the generation of surfaces of potential in higher-dimensional spaces suggesting a procedure for the study of the movement of air masses. Author (TAB)

N70-36220# Minnesota Univ., Minneapolis.
ON IDENTIFICATION OF TIME DELAY SYSTEMS BY STOCHASTIC APPROXIMATION METHOD Scientific Interim Report
H. N. Koivo and A. J. Koivo (Purdue Univ.) Apr. 1970 9 p refs
(Grants AF-AFOSR-1502-68; NSF-GK-1970)
(AD-705219; AFOSR-70-1057TR) Avail: CFSTI CSCL 12/2

The use of a stochastic approximation method to identify parameters of a system with time delay is discussed. The parameters can multiply state variables and/or represent the time delay. Convergence of the identifying algorithm is shown in the mean square sense. Author (TAB)

N70-36234 National Lending Library for Science and Technology, Boston Spa (England).
METHODS FOR SOLVING MINIMISATION PROBLEMS [O NEKOTORYKH METODAKH RESHENIYA ZADACH NA MINIMUM]
S. Ulm et al 1970 16 p refs Transl. into ENGLISH from Eesti NSV Tead. Akad. Toim., Fuus.-Mat. (Tallin), v. 17, no. 2, 1968 p 151–163
(NLL-SMRE-Trans-5807-(B313.4)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Various methods are investigated for the minimization of the functional f(x) in Hilbert space H. The calculations of divided differences of first and second order and an interpolation of Newton's formula for functionals in H are shown. On this basis, the construction of two interpolation analogs of the gradient method for finding local minima f(x) is given. One of the analogs uses the first divided difference instead of the gradient of f(x), and the other the gradient of the interpolation polynomial. A method is given for finding local minima of f(x), in the case of functions of n variables. Proceeding from the generalized Steffensen method, two modifications are shown which use divided differences and the gradient of f(x). Based on an earlier paper, a generalized chord method is given for the constrained minimization of a function f(x). Sufficient conditions for convergence are provided for all the methods. One of the methods is applied to the problem of optimum control and a numerical example of applying the method for solving one of the problems in nonlinear programming is given. Author

N70-36245# Miami Univ., Coral Gables, Fla. Dept. of Physics.
FUNCTIONAL DEPENDENCE OF LAGRANGE MULTIPLIERS
Lawrence Carl Hawkins Mar. 1970 18 p refs
(Contract AT(40-1)-3895; Grant AF-AFOSR-844-67)
(AD-704620; MIAPH-TP-70-3; AFOSR-70-1016TR; ORO-3895-11) Avail: CFSTI CSCL 12/1

Given three variational problems consisting of minimizing a given function(al) subject to one constraint function(al), the three equivalent Lagrange-multiplier problems are deduced and the proper functional dependence of the particular Lagrange multipliers is derived. The results prove the consistency of the use and subsequent physical interpretation of the constant Lagrange multipliers in the plasma, global-stability, variational calculations with integral constraints of Chandrasekhar, of Woltzer, and of Wells and Norwood. Author (TAB)

N70-36267# Naval Postgraduate School, Monterey, Calif.
COMPARISON OF THE KALMAN FILTER AND EXPONENTIAL SMOOTHING TECHNIQUES OF FORECASTING UNITED STATES MARINE CORPS LOSSES IN THE REPUBLIC OF VIETNAM
William Thomas Allison (M.S. Thesis) Oct. 1969 83 p refs
(AD-703229) Avail: CFSTI CSCL 15/7

The report investigates the application of the Kalman Filter and the General Exponential Smoothing techniques of forecasting. Both methods are derived and the similarities and differences between them are discussed. The two techniques are then applied to the practical problem of predicting weekly losses suffered by the U. S. Marine Corps units in the I Corps Tactical Zone in the Republic of Vietnam. The mean absolute error of the prediction is used as the criterion for choosing the better of the two methods. Results are given for both techniques as well as for the method of linear regression. In general the Kalman Filter provides the smallest mean absolute error for the three mathematical models: linear, growing sine with harmonics and frequency of sixteen, thirty-two, and fifty-two weeks, and a constant model. Author (TAB)

N70-36297# Iowa Univ., Iowa City. Dept. of Electrical Engineering.
STOCHASTIC OPTIMAL CONTROL Final Report, Dec. 1968 – Oct. 1969
Earl D. Eyman 15 Dec. 1969 70 p refs
(Grant DA-ARO(D)-31-124-G1090)
(AD-703939) Avail: CFSTI CSCL 12/1

The area of stochastic optimal control was divided functionally into two separate areas: (1) stochstic control and (2) optimal control. In this manner research was done in: (1) The Optimization and Simulation of Linear Stochastic Systems using a Stochastic Maximum Principle, (2) Hybrid Computer Simulation of a Stochastic System, (3) Suboptimal Filter and Filter Sensitivity for Stochastic Parameter Systems, (4) Treatise on Pontryagins Maximum Principle, and (5) Mathematics of Stochastic Modeling with Applications to Stochastic Parameter Sensitivity. Author (TAB)

N70-36302# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
SEMICONTINUITY OF THE FACE FUNCTION OF A

CONVEX SET
Victor Klee and Michael Martin Oct. 1969 33 p refs
(AD-701160; D1-82-0936) Avail: CFSTI CSCL 12/1

The paper began as a study of the convergence properties of an algorithm of H. S. Witsenhausen. His algorithm deals with a linear differential system driven by a bounded perturbation and a bounded control, with a cost that is a convex function of the state reached at a given final time. The controller receives exact samples of the current state of the system at a finite number of sampling times and seeks to minimize the supremum (over-all possible perturbations) of the cost. Witsenhausen proposes a sequence of approximate algorithms, all related to the boundary X of a certain d-dimensional compact convex set K associated with the problem, and shows that the sequence has desirable convergence properties for all points of a certain subset X sub e of X. For the procedure to be fully applicable, X sub e should be all of X, and he shows that this is the case if K is polyhedral or strictly convex. Here we show that X sub e = X when d = 2, thus proving a conjecture of J. B. Kruskal, but that the situation is more complicated when d = or > 3. Specifically, X sub e must be a dense G sub delta subset of X but its (d-1)-dimensional measure may be zero. Thus Witsenhausens algorithm has good convergence properties with respect to category but not necessarily with respect to measure. Author (TAB)

N70-36305# RAND Corp., Santa Monica, Calif.
STANDARD ERROR OF FORECAST IN MULTIPLE REGRESSION: PROOF OF A USEFUL RESULT
Joseph P. De Salvo Apr. 1970 9 p refs
(AD-705906; P-4365) Avail: CFSTI CSCL 12/1

Proof is given that the standard errors of forecasting the dependent variable or the expected value of the dependent variable in a multiple regression reduce to very simple formulas when evaluated at the sample means of the independent variables. These simple formulas involve only knowledge of sample size and the standard error of estimate, the latter of which is typically printed out in computer regression routines. By using these results, one avoids the necessity of calculating the more complicated general formulas for the standard errors in those cases for which evaluation at the mean will suffice. Author (TAB)

N70-36320# Institute for Advanced Study, Princeton, N.J.
SPECIAL PROGRAM IN GROUP THEORY Final Status Report
Armand Borel Mar. 1970 10 p refs
(Grant AF-AFOSR-1468-68)
(AD-704128; AFOSR-70-0993TR) Avail: CFSTI CSCL 12/1

The activity at the Institute for Advanced Study under the Special Program on Finite Groups and Algebraic Groups took place at the Institute during the Academic Year 1968-69. There were two main seminars which took place during the whole academic year: (1) Seminar on Representations of Algebraic Groups and Related Finite Groups. The main theme was the linear representations, both modular and over the complex numbers, of groups of rational points of algebraic groups defined over finite fields, and of certain related finite groups. Also presented were a number of topics in algebraic groups, which were both relevant to this topic and of independent interest. (2) Seminar on Finite Simple Groups. There was first a series of lectures addressed to all participants. The seminar then discussed a number of recent advances in the study and construction of finite simple groups. In addition, there were three series of lectures of shorter duration (from one to two months). (3) Block Theory for the Layman, designed to give an introduction for the non-expert to R. Brauers theory of blocks in representations of finite groups. (4) Simple Groups over Local Fields, and (5) Abstract Homomorphisms of Algebraic Groups. Author (TAB)

N70-36341# RAND Corp., Santa Monica, Calif.
INFINITELY DIFFERENTIABLE FUNCTIONS AND THE HEAT EQUATION
Michael R. Mitchell Apr. 1970 23 p refs
(AD-705831; P-4366) Avail: CFSTI CSCL 12/1

Contents: Infinitely-differentiable and analytic functions; Entire solutions of the heat equation; A class of infinitely-differentiable non-analytic functions; and an infinitely-differentiable non-analytic solution. TAB

N70-36360# RAND Corp., Santa Monica, Calif.
DISCRETIZING DYNAMIC PROGRAMS
B. L. Fox Apr. 1970 8 p refs
(AD-705463; P-4357) Avail: CFSTI CSCL 12/2

Except in rare cases, it is necessary to discretize uncountable-state dynamic programs to obtain even an approximate solution. The paper assumes in the first two sections that the state space is compact, and so a finite grid can be constructed so that any point in the space is in the neighborhood of a grid point. The problem is to find conditions such that the approximations converge to the solution of the original problem as the mesh becomes finer. TAB

N70-36365# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
PROVING INVERSE POSITIVITY OF LINEAR OPERATORS BY REDUCTION
John Schroeder Dec. 1969 22 p refs
(AD-701155; D1-82-0938) Avail: CFSTI CSCL 12/1

A method is presented to prove that a linear operator M is inverse-positive, i.e. Mu = or > o implies u = or > o. The method consists in reducing the problem for the given operator M to a simpler problem. Sometimes, iterated reductions are appropriate, for example, if M is a differential operator of higher order. Author (TAB)

N70-36387# Eidgenossische Technische Hochschule, Zurich (Switzerland).
ON THE GENERALIZED DIRICHLET PROBLEM FOR LINEAR PARTIAL DIFFERENTIAL EQUATIONS [UEBER DAS VERALLGEMEINERTE DIRICHLETPROBLEM FUER LINEARE PARTIELLE DIFFENTIALGLEICHUNGEN]
Peter Hess (Ph.D. Thesis) Helsinki Suomalainen Tiedeakatemia 1969 28 p refs In GERMAN
(Diss-4146) Avail: CFSTI

The generalized Dirichlet problem is used to solve a general linear partial differential equation of arbitrary order and with arbitrary ordered boundary values by transfer into an interrogatory position in the Hilbert space of functions with homogeneous boundary values. The solution requires the existence of a definitely closed linear operator of certain value in the considered Hilbert space. Example calculations presented consider also differentials with unlimited coefficients for elliptical differential equations. Transl. by G.G.

N70-36390# Harvard Univ., Cambridge, Mass. Lab. for Computer Graphics and Spatial Analysis.
GEOGRAPHY AND THE PROPERTIES OF SURFACES. SET OF EQUAL-VALUE ANTIPODAL POINTS FOR TWO CONTINUOUS DISTRIBUTIONS Interim Report
C. Lindgren and S. Ernesto 12 Dec. 1969 13 p refs *Its* No. 37
(Contract N00014-67-A-0298)
(AD-704575; ONR-TR-37) Avail: CFSTI CSCL 12/1

The paper contains a geometric discussion of the question of the determination of antipodal points, on a sphere, at which two continuous distributions are equal-valued. It indicates the possibility of mathematically determining the location of these points when

the two distributions are represented by mathematical functions. It also points out the nature of the points: they might define a continuous geometric locus (a curve on the sphere), be isolated points, or both. Author (TAB)

N70-36413*# Pittsburgh Univ., Pa. Dept. of Physics.
CONFIGURATION SPACE THREE-BODY SCATTERING THEORY. APPENDICES
E. Gerjuoy 30 Jun. 1970 139 p refs
(Grant NGL-39-011-035)
(NASA-CR-112322; SRCC-129-App) Avail: CFSTI CSCL 12A

Details are given for equations and derivation procedures on: (1) convergence of integrals, (2) convergence of iterated expressions, (3) asymptotic behavior of uniterated integrals, (4) application of stationary phase method, (5) asymptotic behavior of singly iterated integrals, and (6) the nine-dimensional configuration space. E.C.

N70-36428# Naval Postgraduate School, Monterey, Calif.
SELECTION OF WEIGHTING MATRICES FOR THE DESIGN OF LINEAR REGULATOR SYSTEMS
James Henry Lindsay, Jr. (M.S. Thesis) Dec. 1969 68 p refs
(AD-706065) Avail: CFSTI CSLC 12/1

The relationship between the weighting matrices and the design objectives for finite-final-time linear regulator systems is considered. An iterative algorithm is presented for selecting a weighting matrix that reduces the absolute difference between the actual and desired values of a vector design measure. The algorithm used the sensitivities of the vector design measure to determine changes for the weighting matrix. These sensitivities are approximated by finite-difference perturbations of the weighting matrix elements. Examples are presented that illustrate the design procedure. Author (TAB)

N70-36462# Naval Postgraduate School, Monterey, Calif.
IDENTIFICATION OF THE INPUT DISTRIBUTION MATRIX FOR LINEAR DYNAMIC SYSTEMS OPERATING IN A STOCHASTIC ENVIRONMENT
Michael Raymond Polk (M.S. Thesis) Jun. 1969 40 p refs
(AD-705072) Avail: CFSTI CSCL 12/1

An algorithm for the identification of the input distribution matrix of a linear, stationary system operating in a stochastic environment is derived. The identification is accomplished by defining a set of autocorrelation functions for a noise element composed of a linear combination of the input distribution matrix elements and the random excitations of the system. Another possible identification method employing a Kalman filter is discussed and the problems associated with its derivation are presented. Results of computer simulations for both methods are included. Author (TAB)

N70-36472# Wisconsin Univ., Madison. Mathematics Research Center.
LINEAR PERTURBATIONS OF ORDINARY DIFFERENTIAL EQUATIONS
Aaron Strauss and James A. Yorke (Maryland Univ., College Park) Sep. 1969 15 p refs Prepared in cooperation with Maryland Univ., College Park
(Contract DA-31-124-ARO-D-462; Grant NSF GP-8914; NSF GP-9347)
(AD-704580; MRC-TSR-1014) Avail: CFSTI CSCL 12/1

Several results are given which concern the problem of the preservation of the stability of a system $x = A(t)x$ which is subject to linear perturbations $B(t)x$, or to perturbations dominated by linear ones. Author (TAB)

N70-36481# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
RATIONAL FUNCTION MINIMAX APPROXIMATIONS FOR THE BESSEL FUNCTIONS K0(x) AND K1(x)
Anne E. Russon and J. M. Blair Oct. 1969 55 p refs
(PB-188664; AECL-3461) Avail: CFSTI CSCL 12A

The report presents rational function approximations for K sub 0(x) and K sub 1(x) for precisions ranging from three to twenty-two significant figures. The coefficients were generated on the CDC-6600 computer using the second algorithm of Remes. Author (USGRDR)

N70-36482# Naval Research Lab., Washington, D.C. Electronics Div.
EVALUATION OF A PROBABILITY DECIDER Interim Report
M. Schmookler Jan. 1970 14 p
(AD-705052; NRL-MR-2098) Avail: CFSTI CSCL 12/1

A statistical decision function that requires at least seven consecutive successes, or eight successes out of any nine trials, from a sample of twenty trials is described explicitly as an algebraic function of the probability of each trial. The effectiveness of a device that uses this function to make decisions, a Probability Decider, is evaluated and compared with two similar Deciders for selected values of p, the probability of success on each trial. Author (TAB)

N70-36484# Naval Postgraduate School, Monterey, Calif.
AN ALGORITHM FOR COMPUTING NON-ISOMORPHIC SEMIGROUPS OF FINITE ORDER
James Stephen Cullen (M.S. Thesis) Jun. 1969 79 p refs
(AD-704511) Avail: CFSTI CSCL 12/1

An algorithm for computing semigroups of finite order is discussed. A computation procedure is developed to generate, for any specified finite order, all semigroups which are distinct up to isomorphism. Additional restrictions are also placed in the generating procedure to produce all groups of the given finite order. The algorithm was placed on the computer and the numerical results for orders one through four obtained. Author (TAB)

N70-36501# Wisconsin Univ., Madison. Mathematics Research Center.
TOW COUNTABLE SYSTEMS OF DIFFERENTIAL INEQUALITIES WITH APPLICATIONS TO THE STABILITY OF LINEAR QUADRATIC DIFFERENTIAL GAMES
D. L. Lukes and Aaron Strauss Jul. 1969 34 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-704579; MRC-TSR-1003) Avail: CFSTI CSCL 12/2

The paper proves that the feedback controls synthesizing the equilibrium solutions to linear quadratic differential games possess certain stability characteristics. Author (TAB)

N70-36503# Wisconsin Univ., Madison. Mathematics Research Center.
SYMMETRIC DUALITY FOR GENERALIZED UNCONSTRAINED GEOMETRIC PROGRAMMING
Elmor L. Peterson Jun. 1969 84 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-704578; MRC-TSR-991) Avail: CFSTI CSCL 12/2

The conjugate transform is used to generalize, symmetrize, and further study Duffins original formulation of duality for unconstrained geometric programming. This study provides new economic interpretations for the geometric dual problem; and it yields new theorems concerning the existence, uniqueness, and characterization of optimal solutions. The economic interpretations come from a new closed-form solution to a related economically interesting class of convex programming problems. Author (TAB)

N70-36512# Wisconsin Univ., Madison. Mathematics Research Center.
INFINITE SYSTEMS OF DIFFERENTIAL INEQUALITIES DEFINED RECURSIVELY Technical Summary Report

Andrzej Lasota (Jagellonian Univ.), Aaron Strauss, and Wolfgang Walter Nov. 1969 28 p refs
Contract DA-31-124-ARO(D)-462; Grants NSF GP-7844; NSF GP-8914)
(AD-704582; MRC-TSR-1021) Avail: CFSTI CSCL 12/1

It is shown that all solutions of certain recursively defined, infinite systems of differential inequalities converge to zero. Convergence is global for initial value inequalities, but only local for boundary value inequalities. Applications to the stability of differential games are sketched. Author (TAB)

N70-36526*# Arizona Univ., Tucson. Coll. of Engineering.
RESEARCH IN AN APPLICATION OF MODERN AUTOMATIC CONTROL THEORY TO NUCLEAR ROCKET DYNAMICS AND CONTROL Interim Report
Robert L. T. Hampton, Cliff A. Harris, and C. H. Lewis Jan. 1970 228 p refs
(Grant NGL-03-002-006)
(NASA-CR-112345) Avail: CFSTI CSCL 12A

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2. STOCHASTIC ALGORITHMS FOR SELF-ADAPTIVE FILTERING AND PREDICTION R. L. T. Hampton 51 p refs (See N70-36528 20-19)

3. THE CONTROL OF NONLINEAR STOCHASTIC CONTROL SYSTEMS UNDER DISCOUNTED PERFORMANCE CRITERIA C. A. Harris 59 p refs (See N70-36529 20-19)

4. LINEAR STABILITY OF A NUCLEAR ROCKET ENGINE WITH TWO REACTIVITY FEEDBACKS C. H. Lewis 33 p refs (See N70-36530 20-28)

N70-36527*# Arizona Univ., Tucson.
STOCHASTIC APPROXIMATION AND ITS ENGINEERING APPLICATIONS
Robert L. T. Hampton *In its* Res. in an Appl. of Mod. Autom. Control Theory to Nucl. Rocket Dyn. and Control Jan. 1970 76 p refs (See N70-36526 20-19)
Avail: CFSTI CSCL 12A

Methods of stochastic approximation and its application to the information sciences are studied. Physical and intuitive meanings are given to the mathematical conditions of stochastic approximation rather than to reproduce rigorous proofs. Author

N70-36529*# Arizona Univ., Tucson.
THE CONTROL OF NONLINEAR STOCHASTIC CONTROL SYSTEMS UNDER DISCOUNTED PERFORMANCE CRITERIA
Cliff A. Harris *In its* Res. in an Appl. of Mod. Autom. Control Theory to Nucl. Rocket Dyn. and Control Jan. 1970 59 p refs (See N70-36526 20-19)
Avail: CFSTI CSCL 12A

Systems described by difference equations and subject to uncertainty as to how they will evolve are reviewed. While much attention was given to the existence of a solution under various conditions, little work was directed toward the development of a practical algorithm. An algorithm for discounted performance criteria is developed. A fundamental study of stochastic control systems is made, which establishes the basis for the development of the algorithm. Author

N70-36553# Eidgenossische Technische Hochschule, Zurich (Switzerland).
ON THE FUNDAMENTAL FORM OF SURFACES IN SPACE [UEBER DIE ZWEITE FUNDAMENTALFORM VON FLAECHEN IM RAUM]
Pierre Jean Erard (Ph.D. Thesis) 1968 70 p refs In GERMAN
(Diss-4234) Avail: CFSTI

Considered are second fundamental forms of surfaces according to the existence and uniqueness theorems of Bennet. Codazzic equations and the theorem egregium are described as differential equation systems for first fundamental values and applied to the Cauchy problem. Various properties of surfaces with constant Gauss curves are developed and it is proven that such a surface without umbilicus allows for a II-connection without violation of the main curve. Infinite deformations are used to characterize surfaces where, besides the second fundamental form, the Gaussian and median curves remain stationary. Deformations on a sphere and rotational surfaces are developed. Transl. by G.G.

N70-36558# Eidgenossische Technische Hochschule, Zurich (Switzerland).
SOME CONGRUENCE THEOREMS FOR CLOSED k-DIMENSIONAL SURFACES IN n-DIMENSIONAL RIEMANN SPACES [EINIGE KONGRUENZSAETZE FUER GESCHLOSSENE K-DIMENSIONALE FLAECHEN IN N-DIMENSIONALEN RIEMANNSCHEN RAEUMEN]
Heinz Bruehlmann (Ph.D. Thesis) 1969 30 p refs In GERMAN
Submitted for publication
(Prom-4058) Avail: CFSTI

Proof is given for the existence of similar sets for k-dimensional surfaces in n-dimensional Riemann spaces. It is assumed that the one pair transformation group of a Riemann space contains two hypersurfaces F and F, which are projected on each other but keep their orientation so that a differential function rests on F. The orientation point rests not only on the surface F but also on a surface obtained by transformation on each point. A special coordinate system is used to prove this theorem and an integral formula is developed to obtain the proper congruence formula. The requirement for the median curve appears now as condition for the median curve vector. Transl. by G.G.

N70-36558# Eidgenossische Technische Hochschule, Zurich (Switzerland).
ON HARMONIC CAPACITY AND QUASI-CONFORMAL MAPPINGS IN SPACE [UEBER HARMONISCHE KAPAZITAET UND QUASIKONFORME ABBILDUNGEN IM RAUM]
Hans Martin Reimann (Ph.D. Thesis) 1969 24 p refs In GERMAN
(Diss-4216) Avail: CFSTI

Developed is a theory of quasi-conformal mapping for a three-dimensional space E that contains many similarities with surface theory. The conformal capacity of a ring R in E is regarded as a homorphic figure that contains all steady differential functions with a boundary value of zero in one boundary component, and all those with a boundary value of one in the other component. Considered is a representation where the conformal capacity is a harmonic ring capacity equal to the value of the Dirichlet integral of that harmonic function in R, which solves the generalized Diricht boundary value problem with values of zero and one on both boundary components. Transl. by G.G.

N70-36560# System Development Corp., Santa Monica, Calif.
AFL WITH THE SEMILINEAR PROPERTY
Seymour Ginsburg and Edwin H. Spanier 10 Feb. 1970 58 p refs
(Contract F19628-67-C-0023; Grant AF-AFOSR-1203-67)
(AD-704813; SDC-TM-738/057/00; AFCRL-70-0199; SR-4)
Avail: CFSTI CSCL 9/2

A slip language is a language whose Parikh mapping is a semilinear set. A slip family is a family containing only slip languages. The purpose of the paper is to study slip AFL. A sufficiency condition is given on a slip family which ensures that the family generates a slip AFL. Using this condition, it is proved

that (1) there exists a largest slip AFL and (2) if L is a slip family then the smallest AFL containing the commutative closure of L is a slip AFL. A new operation called homomorphic replication is then introduced. It is shown that the smallest AFL containing a homomorphic replication of a slip AFL is also a slip AFL. Furthermore, the resulting AFL is principal if the original AFL is principal. It is then proved that the smallest AFL containing all homomorphic replications of the regular sets is not principal. Finally, abstract families of acceptors are presented which, respectively, define the smallest AFL containing a particular homomorphic replication of the regular sets and all homomorphic replications of the regular sets.
Author (TAB)

N70-36565# Iowa State Univ. of Science and Technology, Ames.
ADAPTATIONS OF THE CONJUGATE GRADIENT METHOD TO OPTIMAL CONTROL PROBLEMS WITH TERMINAL STATE CONSTRAINTS
John K. Willoughby Feb. 1970 130 p
(Contract N00014-68-A-0162)
(AD-704905; ERI-62500) Avail: CFSTI CSCL 12/1

The method of conjugate gradients (CG) has been shown to be a rapidly converging and efficient means of solving unconstrained optimal control problems. This dissertation presents some theoretical and computational characteristics of three modifications to the CG algorithm which make it applicable to control problems with terminal state variable constraints. The penalty function method and the projection method have been used to adapt ordinary gradient methods to constrained problems. It is concluded here that the penalty function technique is no more or less advantageous with the CG method than with other gradient techniques. The projection method is shown to be theoretically less compatible with the CG algorithm than with other gradient methods. However, a stepsize adjustment policy is suggested that preserves the rapid convergence that is characteristic of the CG method. It is also shown that nonlinear instead of linear terminal constraints cause no additional theoretical of computational difficulty. A third adaptation of the CG method is given which is original to this study. The method, called the modified conjugate gradient method (MCG), is applied to constrained problems by using constant Lagrange multipliers which converge to their optimal values as the iteration proceeds. A unique feature of the MCG method is that each control iterate produced by the method causes the constraints to be satisfied exactly. Furthermore, the technique is equally applicable to nonlinear and linear terminal state constraints.
Author (TAB)

N70-36568*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TRIANGULAR DECOMPOSITION AS AN AID IN DETERMINING EIGENVALUES OF LARGE-ORDER BANDED SYMMETRIC MATRICES
Edward F. Puccinelli Mar. 1970 26 p refs Submitted for publication
(NASA-TM-X-65301; X-321-70-228) Avail: CFSTI CSCL 12A

In determining a subset of eigenvalues of the eigenspectrum of a real symmetric matrix it cannot always be determined that all the eigenvalues in a certain region of the real axis have been found. Triangular decomposition is described as an essential step, in many eigenvalue solution methods, to form a Sturm sequence. By forming two Sturm sequences the number of eigenvalues in any region of the real axis can be determined. First, matrix decomposition is discussed followed by a description of how a symmetric matrix decomposition can always be made. Next it is shown how the diagonal terms of the U matrix in a symmetric LU decomposition form a Sturm sequence and finally how this information can be used in conjunction with the determinant method of eigenvalue solution.
Author

N70-36572# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
ON THE SOLUTION OF OPTIMAL CONTROL PROBLEMS WITH STATE VARIABLE INEQUALITY CONSTRAINTS
William E. Hamilton and Violet B. Haas Feb. 1970 163 p refs
(Contract N00014-67-A-0226-0004)
(AD-705267; TR-EE70-8) Avail: CFSTI CSCL 12/1

The report deals with theoretical and computational aspects of optimal control problems with state variable inequality constraints. The computational methods developed here solve bounded state variable problems by searching the constraint surface (or boundary) for the optimal junction point between the subarc on the boundary and the unconstrained subarc. The results obtained for the bounded state variables problem are extended to problems with discontinuous state variable and/or discontinuous differential equations.
Author (TAB)

N70-36578*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A UNIVERSAL SOLUTION OF LAMBERT'S PROBLEM
E. R. Lancaster and R. H. Estes Aug. 1970 10 p refs
(NASA-TM-X-65306; X-643-70-302) Avail: CFSTI CSCL 12A

The problem of Lambert is reduced to the solution of a single equation which is valid for elliptic, parabolic, and hyperbolic motion. The equation has no singularity for 180 deg transfers, holds for any number of revolutions, and expresses a normalized time of flight as a function of one parameter and a universal two-body variable.
Author

N70-36579*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN ALGORITHM FOR INTEGRATING SIMULTANEOUSLY THE RESTRICTED PROBLEM AND ITS FIRST VARIATIONS IN THIELE'S COORDINATES
R. H. Estes Aug. 1970 10 p refs
(NASA-TM-X-65305; X-643-70-301) Avail: CFSTI CSCL 12A

In the search for periodic orbits in the planar restricted problem of three-bodies, it is of interest to integrate simultaneously the orbital and variational equations in regularizing coordinates. An efficient algorithm for the integration of the equations of motion of the restricted problem in Thiele's variables was previously presented; and it is the purpose of this note to extend the algorithm to include the variational equations.
Author

N70-36587# Tokyo Univ. of Education (Japan). Dept. of Physics.
TWISTING INVARIANT FACTORIZATION, LINEAR DEPENDENCE AND THE LOOP AMPLITUDES, IN DUAL RESONANCE MODEL
Sunao Sakai [1970] 24 p refs
(TUEP-70-12) Avail: CFSTI

The factorization of multi-point dual resonance model in the new base vectors which are eigenstate of twisting transformation is proposed. In this factorization the twisting operator has the simple form, and the generator of infinitesimal gage transformation changes sign under the twisting transformation. It was found that by inserting the projection operator the divergence is decreased only by one power for the non-planer loop amplitudes with even numbers of twisting operators, and the divergence is not decreased at all for the non-planer loop amplitude with odd numbers of twisting operators.
Author

N70-36619# Naval Postgraduate School, Monterey, Calif.
PHASE-PLANE METHODS
Yun-Lan Hsiung (M.S. Thesis) Oct. 1969 246 p refs
(AD-706050) Avail: CFSTI CSCL 12/1

The phase-plane method is a graphical method for linear and nonlinear second-order systems. There are many techniques for

obtaining the phase portrait which consists of a number of phase trajectories on the phase plane. From the summary and discussion the isocline method is a most general and useful method. The only difficulty is in the labor required. Solution by digital computer reduces this difficulty and makes the isocline method a much more useful method in non-linear systems analysis and design applications. Author (TAB)

N70-36638# Eidgenossisches Technische Hochschule, Zurich (Switzerland).
ON THE CONVERGENCE OF A JACOBI METHOD FOR SIMPLE AND GENERALIZED EIGENVALUE PROBLEMS [ZUR KONVERGENZ EINES JACOBIVERFAHREN FUER GEWOEHNLICHE UND VERALLGEMEINERTE EIGENWERTPROBLEME]
Katharina Zimmermann (Ph.D. Thesis) 1969 43 p refs In GERMAN
(Diss-4305) Avail: CFSTI

The cyclic Jacobi method is used to determine eigenvalues of a symmetrical matrix in relation to an asymptotic symmetric positive defined matrix. A convergence proof is given and a rotation method for real symmetrical matrix pairs is described that uses a generalized Jacobi operator. Transl. by G.G.

N70-36664# RAND Corp., Santa Monica, Calif.
ESTIMATION OF THE MEAN OF A WIDE-SENSE STATIONARY AUTOREGRESSIVE SEQUENCE
George S. Fishman Apr. 1970 23 p refs
(AD-705830; P-4358) Avail: CFSTI CSCL 12/1

The study concerns the relative efficiency of the least-squares estimator of the mean of a covariance stationary sequence that has a constant mean and an autoregressive representation of order p. The results augment those of Chipman, et al. who studied this topic for the case p = 1. Relative efficiency is defined as the ratio of the variance of the best linear unbiased estimator (BLUE) of the mean and the variance of the least-squares estimator (LSE) of the mean. Section 2 presents the problem definition and principal results. Graphical results for the first-order scheme (p = 1) in Sec. 3 imply that the relative desirability of the LSE should be based on variance as well as relative efficiency considerations. TAB

N70-36761# Wisconsin Univ., Madison. Mathematics Research Center.
ESTIMATING PARAMETERS, TESTING FIT, AND ANALYZING UNTRANSFORMED DATA PERTAINING TO THE NEGATIVE BINOMIAL AND OTHER DISTRIBUTIONS
John Gurland and Paul Hinz (Iowa State Univ. of Sci. and Technol.) Oct. 1969 57 p refs Prepared in cooperation with Iowa State Univ. of Sci. and Technol.
(Contract DA-31-124-ARO(D)-462)
(AD-704581; MRC-TR-1015) Avail: CFSTI CSCL 12/1

Testing a general linear hypothesis pertaining to untransformed data is accomplished by minimum chi-square techniques without assumptions required in ordinary analysis of variance. Author (TAB)

N70-36765# Naval Research Lab., Washington, D.C. Mathematics Research Center.
A NOTE ON VAN DER WAERDEN'S THEOREM ON ARITHMETIC PROGRESSIONS Final Report
John R. Rabung 14 Apr. 1970 6 p refs
(AD-705354; NRL-7073) Avail: CFSTI CSCL 12/1

Some computational results are presented concerning arithmetic progressions of members of strictly increasing sequences of positive integers with bounded differences between adjacent sequence members. The connection between this problem and some aspects of Van der Waerdens theorem on arithmetic progressions is discussed briefly. Author (TAB)

N70-36766# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
SOLVING BOUNDARY-VALUE PROBLEMS BY IMBEDDING
E. Wasserstrom [1970] 28 p refs
Avail: CFSTI

Boundary-value problems of nonlinear ordinary differential equations are reformulated as a rather complicated initial value problem, whose solution is more adaptable to numerical computations. Several examples are solved. The advantages and drawbacks of the method are briefly discussed. Author

N70-36789# State Inst. for Technical Research, Helsinki (Finland). Lab. of Concrete Technology.
AN APPROXIMATE SOLUTION OF A QUASI-LINEAR DIFFUSION PROBLEM: TABLES AND NOMOGRAMS FOR CONCENTRATION IN SLABS IN A SPECIAL CASE
S. S. H. Kasi and S. E. Pihlajavaara 1969 74 p refs Sponsored by State Commission for Technology
Avail: CFSTI

A computer program is prepared for a special case of quasi linear diffusion problems. The program is given in two parts: one includes all stages of the relations u = C - (C sub e)/(C sub 0) - (C sub e) where C is the concentration, (C sub 0) is a uniform initial value, and (C sub e) is its constant value on the other boundary of the x-interval. The other remains unchanged with alteration in the function D(u) or its representative. For this special case, tables and nomograms are given for diffusion concentration in the drying of wet concrete slabs. Included in the program results are distribution of concentration, average concentration, and flux on the open surface. E.H.W.

N70-36790*# Rice Univ., Houston, Tex. Dept. of Mechanical and Aerospace Engineering and Materials Science.
GRADIENT TECHNIQUES FOR AEROSPACE APPLICATIONS Final Report, 1 Jun. 1969 - 31 May 1970
Angelo Miele 31 May 1970 14 p refs
(Grant NGR-44-006-089)
(NASA-CR-112666) Avail: CFSTI CSCL 12A

Gradient techniques of interest in optimization theory, with particular regard to aerospace applications, are investigated. Typical mathematical areas are gradient methods for unconstrained variational problems, gradient methods with restoration of constraints, memory gradient methods, supermemory gradient methods, gradient methods with bounded control, gradient methods with bounded state, and gradient methods with free final time. Reports on analytical results are abstracted, with a reference bibliography included. Author

N70-36816*# Rochester Univ., N.Y. Center for System Science.
LIAPUNOV FUNCTIONS FROM AUXILIARY EXACT DIFFERENCE EQUATIONS FOR NONLINEAR DIFFERENCE EQUATION STABILITY ANALYSIS
Kun E. Park and Edwin Kinnen May 1970 32 p refs
(Grant NGR-33-019-014)
(NASA-CR-112385; CSS-70-11) CSCL 12A

A mathematical structure is presented to determine the stability of nonlinear difference equations by the second method of Liapunov using a direct extension of a procedure recently proposed for nonlinear differential equations. Definitions are given for the gradient of an implicit function of a discrete variable, a principal sum, a definite sum, and an exact difference equation, analogous to the corresponding quantities for an implicit function of a continuous variable. A theorem for exactness of a difference form

is proved. It is then shown that Liapunov functions to determine the stability of nonlinear autonomous difference equations can be developed through the use of auxiliary exact difference equations. Author

N70-36819# Naval Fleet Material Support Office, Mechanicsburg, Pa.
STATISTICAL TRAINING MANUAL, VOLUME 3
B. H. Bissinger 31 Mar. 1970 167 p refs
(AD-705740; ALRAND-50-B-Vol-3) Avail: CFSTI CSCL 12/1

The report is the edited notes of a series of in-house lectures on joint distribution functions, derived distribution functions, and expectations. The chapter on joint distribution functions examines both the continuous and discrete case. Derived distribution functions include monotonic transformations, generating functions, convolution theory, and compound distributions. The chapter on expectations deals with conditional means and variances, covariances, cost and effectiveness functions. Numerous graphs and sample problems are used to illustrate the various principles considered. Author (TAB)

N70-36823# Technische Hogeschool, Eindhoven (Netherlands).
OPTIMAL CONTROL OF DIFFERENTIAL SYSTEMS WITH DISCONTINUOUS RIGHT-HAND SIDE
Matheus Lodewijk Johannes Hautus 29 Jun. 1970 101 p refs
Avail: CFSTI

Optimal control problems are solved by dividing the trajectory into pieces on which f is continuously differentiable and the maximum principle holds. After each piece is optimized, it is fitted back into the whole trajectory. A yo yo equation is presented and sample problems are solved using a dynamic programming method and discrete maximum principle. Notations used are derived, and existence and uniqueness theorems for differential equations are discussed. A maximum principle and a theorem are given which assure the existence of an optimal control for a system where f depends linearly on x. J.M.

N70-36875# Naval Research Lab., Washington, D.C. Intercept and Signal Processing Branch.
AN EXTENSION OF GHAZALA'S METHOD TO INCOMPLETELY SPECIFIED MULTIPLE-OUTPUT FUNCTIONS
John R. Miller 19 Feb. 1970 33 p refs
(AD-702736; NRL-7028) Avail: CFSTI CSCL 12/1

A method for computing the presence function for an incompletely specified multiple-output Boolean function has been derived. This method, which is a generalization of Ghazalas algorithm for computing the presence function for a completely specified single-output Boolean function, does not require the use of a table of combinations (unless the function is originally specified by a table of combinations) and does not involve the construction of a basic cell matrix. Thus the use of this method in computer programs which determine minimal (or at least irredundant) covers for incompletely specified Boolean functions may in some cases result in a saving of execution time and memory space required. Author (TAB)

N70-36917# Imperial Coll. of Science and Technology, London (England). Thermofluids Section.
HEAT AND MASS TRANSFER IN RECIRCULATING FLOWS. LECTURE 1: THE BASIC DIFFERENTIAL EQUATIONS
R. G. Taylor Dec. 1968 33 p refs Lecture presented at Post-Experience Course, London, 17-19 Dec. 1968
(EF/TN/A/5) Avail: CFSTI

A method for solving the set of differential equations which represent steady fluid flow that is either axisymmetric or two-dimensional is presented for facilitating numerical solution by digital computer. The cross flow of heat exchangers, the flow under a hovercraft, and duct flow are cited as examples of the fluid flow, and the general properties considered are: (1) thermodynamic properties, (2) chemical reaction, (3) laminar transport properties, (4) turbulent transport properties, and (5) boundaries. The basic differential equation, and the main features of the coordinate frame with the special coordinate sets are given. F.O.S.

N70-36918# Imperial Coll. of Science and Technology, London (England). Thermofluids Section.
HEAT AND MASS TRANSFER IN RECIRCULATING FLOWS. LECTURE 2: FINITE-DIFFERENCE EQUATIONS
D. B. Spalding Dec. 1968 29 p refs Lecture presented at Post-Experience Course, London, 17-19 Dec. 1968
(EF/TN/A/6) Avail: CFSTI

Partial differential equations (pde) are changed into finite-difference equations (fde) for solution by numerical analysis. Topics discussed include: (1) the relation between the solutions of the pde and of the fde, (2) solution procedures for fde, (3) accuracy of fde formulation, (4) convergence of solution procedures, and (5) application to elliptic-flow equations. The conclusions reached about fde formulations are: central-difference formulae are neither accurate nor convergent; upwind-difference formulae are convergent, and moderately accurate; and it is possible to devise convergent formulae that are more accurate. F.O.S.

N70-37203# Joint Publications Research Service, Washington, D.C.
ANALYTICAL SOLUTION OF THE PROBLEM OF CONTROLLING A SPATIAL TURNING MANEUVER
B. N. Petrov et al 20 Aug. 1970 9 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 192, no. 6, 1970 p 1235–1238
(JPRS-51214) Avail: CFSTI

An analytical solution of the problem of synthesizing the orientation control algorithm is presented. The principle of extensive control is used. This principle consists of selecting the vector of the control moment, limited with respect to magnitude from vehicular motion about the given axis when applying the components of the moment with respect to the connected axes. Author

N70-37204# Atomic Energy Commission, New York. Health and Safety Lab.
COMPUTATIONAL METHOD FOR PHOTOPEAK LOCATION AND INTEGRATION
R. T. Graveson Apr. 1970 43 p refs
(HASL-225) Avail: CFSTI

The statistical broadening of a total energy absorption peak in pulse height spectroscopy complicates the identification of the mean pulse height and the assessment of the total counts included within the peak. A set of sequential computations has been developed to reduce observed spectral peaks to their basic parameters of location, width, and total area. The first equations are used to obtain the charge calibration of the electronic system. Background is subtracted from the spectral peak by an exponential estimate of the continuum. The location of the corrected peak is determined by the fitting of a parabola to the observed data. The statistical width is derived from a normalized Gaussian fit. The results of these computations are used to calculate the peak parameters. Author (NSA)

N70-37220# Liege Univ. (Belgium). Astrophysics Inst.
OSCILLATIONS AND STABILITY STUDIES OF JEAN SPHEROID AND ROCHE ELLIPSOID [ETUDE DES OSCILLATIONS ET DE LA STABILITE DU SPHEROIDE DE JEANS ET DE L'ELLIPSOIDE DE ROCHE]
H. Robe 1969 69 p refs In FRENCH Sponsored in part by Min. of Natl. Educ. and Culture Prepared in cooperation with the Univ. Found. of Belgium *Its* Rept. of the Roy. Sci. Soc. of Liege,

Ser. 5, Vol. 18, Pt. 1
Avail: CFSTI

Two figures are studied for dynamic stability and a general method of small perturbations. A general formula is established for spherical oscillation frequencies and heat values are determined for the ellipsoid associated with Lame harmonics of 2 and 3 degrees. Secular stability of the two figures are considered using the coefficient method by Poincare and the equations of motion. It is shown that secular instability of the ellipsoid precedes the dynamic sound instability that is apparent for a pure viscous mode. Transl. by E.H.W.

N70-37231*# Arecibo Ionospheric Observatory, Puerto Rico.
PARAMETER ESTIMATION FROM SETS OF TWO-DIMENSIONAL MAPS
R. F. Jurgens *In* JPL Sci. Appl. of Radio and Radar Tracking in the Space Program 1 Jul. 1970 p 51–55 refs (Sponsored by Cornell Univ., ARPA, and NSF (See N70-37226 20-30)
Avail: CFSTI CSCL 12A

A procedure is presented for determining a set of unknown parameters which establish the transformation equations between a set of two-dimensional maps and a single map which is considered to be invariant once the proper parameters are established; that is, any single map of the set would yield the same map after the transformation is applied. The procedure is based on the maximization of a cross-correlation coefficient which is a function of the two dimensional maps, and the parameters. The particular application of the procedure to the determination of the spin vector of Venus is considered where the parameters are the vector components of the spin axis, and the two-dimensional map set corresponds to a sequence of delay-Doppler radar maps. The procedure also appears to be useful for parameter determination from sequences of two-dimensional optical or photographic maps. Author

N70-37249# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
ON A SIGN OF AN IMAGINARY PART OF QUASI-POTENTIAL
P. N. Bogolyubov 1970 11 p refs In RUSSIAN
(JINR-P2-5021) Avail: AEC Depository Libraries

It is shown that in the expression for quasi-potential there appears a possitive imaginary part. Author (NSA)

N70-37350# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
FLAT-SPACE LIMIT OF AN EXACT SOLUTION FOR STATIC GRAVITATIONAL-MASSLESS SCALAR FIELD
R. A. Asanov 1970 7 p refs
(JINR-E2-5005) Avail: AEC Depository Libraries

The ordinary flat-space limit of the exact static exterior spherically symmetric solution of Einstein equations is obtained when a massless scalar field is present. The result differs from that of Janis, Newman and Winicour, who arrived at the incorrect conclusion that there is an essential singularity in this limit. The essential singularity is scalar field constant G (when G approaches limit of 0) is found near the origin ($r = 0$) only, where the solution from the very beginning has a singularity in r. No singularity at the space infinity occurs and the exterior solution is unique. (NSA)

N70-37364*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NUMERICAL INTEGRATION OF ORBITS IN MULTIREVOLUTION STEPS
C. W. Velez Washington Sep. 1970 21 p refs
(NASA-TN-D-5915; G-972) Avail: CFSTI CSCL 22C

A predictor-corrector algorithm applicable to the numerical integration of an artificial earth satellite in multirevolution steps is reviewed. The multirevolution predictor and corrector formulas are developed to yield general recursive relations for the coefficients, which are similar to those for the Adams integration formulas. In addition, the applicability of the algorithm to orbit calculations is demonstrated numerically. Author

N70-37372# California Univ., Berkeley. Operations Research Center.
SUFFICIENT CONDITIONS FOR OPTIMAL CONTROL WITH STATE AND CONTROL CONSTRAINTS
Harold L. Stalford Mar. 1970 31 p refs
(Grant NSF GP-15473)
(PB-191220; ORC-70-8) Avail: CFSTI CSCL 12A

A monotonicity result is used to derive sufficient optimality conditions of considerable generality for an individual trajectory in control theory. The sufficiency theorem embodying these conditions generalizes those of Boltyanskii and Leitmann and is applied to a simple control system to which their sufficiency theorems are not applicable. Conditions on the state equations and state space are completely relaxed. The set of admissible controls is extended to the set of measurable controls and the integrand of the performance index has its membership extended to the class of bounded Borel measurable functions. The decomposition of the state space is required to be only 'plain' denumerable. Author (USGRDR)

N70-37454# California Univ., Berkeley. Operations Research Center.
ON THE TIME INTERSECTIONS OF TRAJECTORIES AND MANIFOLDS
Harold L. Stalford Mar. 1970 30 p refs
(Grant NSF GP-15473)
(PB-191221; ORC-70-7) Avail: CFSTI CSCL 12A

The set of times which a trajectory can intersect a lower dimensional submanifold contained in the range space of the trajectory is studied. It is shown that this set of times can be any closed subset of the time domain. The existence of trajectories having surprising time intersections with manifolds is shown. Author (USGRDR)

N70-37504*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PARAMETRIC SENSITIVITY ANALYSIS FOR STAGED PROPULSIVE VEHICLES
G. R. Woodcock 26 Sep. 1969 29 p
(NASA-TM-X-53945; MSFC-IN-ASO-67-2) Avail: CFSTI CSCL 12A

A mathematical method from random variable theory was used to analyze simultaneous variation of engine performance and stage inert weight for some typical 2-stage rocket vehicles. This represents an extension of the conventional sensitivity analysis which is often performed for conceptual designs. The study was incomplete in that too few examples were analyzed for conclusions to be drawn regarding the usefulness of the approach, but mathematical consistency was shown. Author

N70-37592# Tulane Univ., New Orleans, La. Newcomb Coll.
MINIMAL VECTOR LATTICE COVERS
Paul F. Conrad [1969] 4 p refs
(Grant NSF GP-9004)
Avail: Issuing Activity

It is shown that each abelian 1-group G is a large 1-subgroup of a minimal vector lattice V, and, if G is Archimedean, then V is unique. If G is non-Archimedean, then V need not be unique, even if G is totally ordered. The following propositions are investigated:

(1) Each 1-group G admits a v-hull. Thus, if G is a 1-subgroup of a unique minimal vector lattice U, then U must be a v-hull of G. (2) An Archimedean 1-group G admits a unique v-hull. This v-hull is (1-isomorphic to) the 1-subspace of the Dedeking-MacNeille completion of the divisible hull of G that is generated by G and hence it is Archimedean. (3) Each v-hull of an o-group G is an o-group, but it need not be an a-extension. An o-group G admits a v-hull that is an a-extension, but it need not be unique. P.A.B.

N70-37597# Institute for Advanced Study, Princeton, N.J.
GEOMETRIC IDEAS IN LIE GROUP HARMONIC ANALYSIS THEORY
Robert Hermann Apr. 1970 84 p refs
(Contract N00014-69-C-0265)
(AD-706101; ONR-TR-2) Avail: CFSTI CSCL 12/1

Some underlying geometric-group theoretic principles are developed that have a wide applicability to problems in group representation theory and mathematical physics. Applications are presented to such topics as: Asymptotic behavior of group representation matrix elements; generalized functions on manifold; contraction of the Poincare to the Gibleon group; generalized function solutions of the Klein-Gordon equation; and rapidly decreasing functions on manifolds and Lie groups. Author (TAB)

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N70-36205# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
RELATIONSHIPS BETWEEN CLIMATE AND REGIONAL VARIATIONS IN SNOW COVER DENSITY IN NORTH AMERICA
Michael A. Bilello Dec. 1969 26 p refs
(AD-700990; CRREL-RR-267) Avail: CFSTI CSCL 8/12

Analysis of snow-cover observations made during November - March at 27 stations in Alaska, Canada and the northern United States for a 2 to 11 year period showed that the average snow density can be classified in four general categories. A nomograph in which the average winter air temperature and wind speed are the independent variables makes it possible to estimate the average snowcover density for any location in the Arctic, subarctic and North Temperate Zones. A comparison between observed and estimated densities for ten other test stations yielded a correlation coefficient of 0.91 with a standard error of estimate of 0.016 g/cu cm. An average snow density map of North America was drawn and the continent was divided into areas based on the four categories. Author (TAB)

N70-36213 National Lending Library for Science and Technology, Boston Spa (England).
ON THE CONDITIONS IN WHICH A THERMAL WITH LARGE CONDENSATION NUCLEI BREAKS THROUGH A CONVECTION INHIBITING LAYER
S. V. Psenaj-Severin et al 9 Apr. 1970 13 p refs Transl. into ENGLISH from Tr. Inst. Eksp. Met. (USSR), no. 6, 1969 p 97-107
(NLL-M-9066-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

Data are given on the the relations between condensation processes and the dynamics of thermals, and optimum conditions are found for the method of cloud generation by ejecting salt particles into the air, from an aircraft or ship. A specially homogeneous thermal, ascending adiabatically in a layer of the atmosphere with given lapse rates for temperature and humidity, is considered, and it is assumed that the monodisperse condensation nuclei enter the thermal. Variations which are considered include the following: the equilibrium nuclei enter a thermal with positive initial speed; the nonequilibarium nuclei enter the static volume of air; and an unstable lower is combined with a stable upper layer. It was concluded that: (1) Addition of active nuclei can have an appreciable effect on the dynamics of a thermal leading to an increase in the distance it covers in a stable layer. (2) That a thermal should break through a convection-inhibiting layer is a necessary, but not sufficient, condition for the thermal to become a cloud. (3) Nuclei which are injected must fill a region of more than a critical size. (4) The effect of the nuclei is determined by the total concentration. N.E.N.

N70-36215 National Lending Library for Science and Technology, Boston Spa (England).
THE FORMATION OF SEA FOGS OF THE EVAPORATION TYPE AND SOME RECOMMENDATIONS CONCERNING THEIR FORECASTING
F. S. Terziev 9 Apr. 1970 17 p Transl. into ENGLISH from Tr. Nauchn.-Issled. Cent. SSSR, Gidromet. (Leningrad), no. 48, 1969 p 25-38
(NLL-M-9054-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

Meteorological parameters which can be obtained by direct observation were found for use in forecasting evaporation type sea fog. The difference in the water temperature and the air temperature was plotted against water temperature. These monograms were used to forecast fog occurrence without the intensity. It is shown that when the difference in water temperature and the air temperature is 15 and more, the probability of dense fog occurring is over 85%. It was found that 90% of the fog occurrences formed with wind speeds of less than 3 m/sec. F.O.S.

N70-36246 National Lending Library for Science and Technology, Boston Spa (England).
SLANT AND VERTICAL VISIBILITY IN ADVECTION FOGS
M. Ja. Racimor 8 Apr. 1970 12 p refs Transl. into ENGLISH from Tr. Nauchn.-Issled. Cent. SSSR, Gidromet. (Leningrad), no. 48, 1969 p 14-24
(NLL-M-9070-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Eng.: .1 NLL photocopy coupons

Previous experimental flights were made to measure the visibility below low clouds, and equations for determining the transparency and the slant visibility of lights during established variations of horizontal visibility with height in the layer below the clouds were also determined. Corresponding equations are derived for calculating the slant visibility of lights in advection fogs to a first approximation, using a light-pulse device to measure the height of the cloud base. R.B.

N70-36250# Environmental Technical Applications Center (Air Force), Washington, D.C.
US NAVAL WEATHER SERVICE WORLD-WIDE AIRFIELD SUMMARIES. VOLUME 8, PART 8: UNITED STATES OF AMERICA (ALASKA AND HAWAII)
Apr. 1970 225 p
(AD-704607) Avail: CFSTI CSCL 4/2

The volume is part of a series of compilations which is world-wide in scope. It consists of climatological summaries for selected airfields in Alaska and Hawaii and for the climatic areas in which they are located. Author (TAB)

N70-36281 National Lending Library for Science and Technology, Boston Spa (England).
ON THE RELATIONSHIPS BETWEEN AIR POLLUTION AND SELECTED METEOROLOGICAL DATA ILLUSTRATED

BY AN EXAMPLE OF SEVERAL YEARS MEASUREMENTS OF SO2 AND NO2

A. Knauer 8 Apr. 1970 8 p Transl. into ENGLISH from Z. Meteorol. (Berlin), 20, 1968 p 109-115 Presented at Conf. on Tech. Meteorology of the Meterol. Soc. in the DDR, 22-24 Sep. 1966

(NLL-M-9051-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

The NO2 and SO2 concentrations were determined. A survey is given of air-hygiene loading conditions at the measurement point. To show the relationships between concentration and air temperature, the variations of monthly mean SO2 and NO2 concentrations are compared with the variation of air temperature. It is shown that the curves for SO2 and air temperature are in almost complete agreement. Author

N70-36269 National Lending Library for Science and Technology, Boston Spa (England).

GEOPOTENTIAL PULSES IN NOVEMBER AS INDICATORS OF JANUARY AIR TEMPERATURE

D. A. Drogajcev 9 Apr. 1970 18 p refs Transl. into ENGLISH from Tr. Nauchn.-Issled. Cent. SSSR, Gidromet. (Leningrad), no. 42, 1969 p 14-28

(NLL-M-9081-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Based on the dependence of air temperature in January on the properties of the general circulation during the previous November, the extent to which January air temperature depends on the effects of strong inter-period pulses of a rise or fall of the geopotential height of the 500 mb surface in November is investigated. The pulses are the characteristic features of the most important changes in the high-level pressure field which occur between one natural synoptic period and the next in a continuously evolving process. Author

N70-36316 National Lending Library for Science and Technology, Boston Spa (England).

LONG-TERM VARIATIONS IN TROPOSPHERICAL CIRCULATION IN THE PERIOD 1949-1966

K. Bayer et al 24 Jun. 1970 13 p refs Transl. into ENGLISH from Ann. Met. Neue Folge, no. 4, 1969 p 221-226

(NLL-M-9213-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

A synoptic analysis is made of annual means of the air pressure field over the North Atlantic and adjacent parts of North America and Europe. Correlations are made in changes of the Iceland low with the Azores, of the Polar anticyclone with the Sahara low, and the Asian high with Iranian low. It is noted that the atmospheric circulation over Western and Central Europe is determined by the north to south pressure gradient over the North Atlantic. Four marked annual waves are discussed, and it is concluded that there are real tendencies in atmospheric circulation lasting for a number of years. N.E.N.

N70-36326 National Lending Library for Science and Technology, Boston Spa (England).

DIURNAL VARIATION OF THE TEMPERATURE DIFFERENCES BETWEEN DOWNTOWN AND SUBURBAN STATIONS IN BUDAPEST

Ferenc Probald 24 Jun. 1970 9 p refs Transl. into ENGLISH from Magy. Met. Tars. Foly., Idoj. (Hungary), 1969 p 49-53

(NLL-M-9181-(5928.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

Thermograph recordings made during three years at the downtown observing station of the Hungarian Meteorological Service and at the Pestlorinc Observatory form the basis for determination of diurnal variation of temperature difference. The temperature difference between the downtown area and the suburban location, during the whole year, is more important in the nocturnal radiation period, and the amplitude of diurnal variation is greater in the summer and in clear weather. In winter, the city area is warmer than its surroundings during the entire day. The temperature difference is higher in the wintar even if computed from so-called real daily average temperatures rather than from average values of observations made at given hours. Author

N70-36329 National Lending Library for Science and Technology, Boston Spa (England).

ON THE RELATION BETWEEN THE FORCE OF DEFORMATION AND THE MOVEMENTS OF ATMOSPHERIC CENTRES OF ACTION

I. V. Maksimov et al 24 Jun. 1970 6 p refs Transl. into ENGLISH from Dokl. Akad. Nauk (Moscow), no. 190, 1970 p 1095-1097

(NLL-M-9220-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

Considered is the effect of the earth deformation force on atmospheric processes. It is shown that the vertical component is very small compared with the acceleration due to gravity, and so its effect on processes in the earth's atmosphere can be neglected. But the horizontal component of the deformation force is comparable with forces which act in the horizontal plane, and so acquires particular importance in the study of the dynamics of atmospheric processes. The amplitude of 14 month movements of the center of the Iceland low in a N-S direction was roughly 1.5 times as great as the corresponding movements of the Azores high. In E-W direction the relationship was less marked. Author

N70-36330 National Lending Library for Science and Technology, Boston Spa (England).

THE QUESTION OF THE SPATIAL DISTRIBUTION OF ZONES (OF CONVECTION CURRENTS) WITH MAXIMUM WATER CONTENT IN CUMULUS CLOUDS

V. I. Skackit 3 Apr. 1970 10 p refs Transl. into ENGLISH from Tr. Inst. Eksperim. Meteorol. (Moscow), v. 6, 1969 p 115-118

(NLL-M-9060-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

Determined are the most likely positions of zones (convective currents) with maximum water content in a cumulus cloud on the basis of a large number of water content measurements made in developing droplet clouds from which no precipitation was falling. Considered are the results of water content measurements obtained in 1800 flights through developing cumulus clouds of 500 to 5000 m thickness. Author

N70-36345 National Lending Library for Science and Technology, Boston Spa (England).

VARIATION OF WIND DIRECTION WITH HEIGHT IN THE LOWER LAYERS OF THE ATMOSPHERE

M. M. Borisenko et al 1970 11 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 246, 1969 p 48-55

(NLL-M-9053-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

Measurements in variations of wind direction with height in the boundary layer are reported from a 300 meter meteorological mast. Experimental data support the combined use of radar echoes, barometric levelling, radiosondes, and television masts for accurate measurements. E.M.C.

N70-36348 National Lending Library for Science and Technology, Boston Spa (England).

AN OBJECTIVE METHOD FOR MAKING 1-2 HOUR FORECASTS OF THE HEIGHT OF THE CLOUD

M. V. Rubinstejn 8 Apr. 1970 13 p refs Transl. into ENGLISH

from Tr. Nauchn.-Issled. Cent. SSSR, Gidromet. (Leningrad), no. 45, 1969 p 3–13
(NLL-M-9090-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

Relationships between the surface meteorological elements observed directly at the point of forecast and subsequent changes in the height of the cloud base two hours later are studied to forecast the lowering of cloud bases. A composite graph of three parameters (dew-point deficit, initial wind speed and initial height of clouds) was used for preparing forecasts of significant lowering of the cloud base. It is concluded that this method should be used to supplement synoptic methods. F.O.S.

N70-36353# Joint Publications Research Service, Washington, D.C.
METEOROLOGY
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No. 233 29 Jul. 1970 p 5–11 (See N70-36351 20-34)
Avail: CFSTI

News briefs and abstracts of articles are reported on mountain climatology, light scattering in the atmosphere, satellite measurements of the field of terrestrial brightness, measurement of terrestrial emission by Cosmos 243, correcting response of satellite infrared radiometers, evaluation of the Lagrangian of the turbulence time scale, the statistical characteristics of the brightness indicatrix at 17.5 km, the emissivity of lower-level clouds, and spectral coefficients of radiation attenuation by haze. R.B.

N70-36367# Weather Wing (1st), San Francisco, Calif.
JANUARY CLIMATE OF SOUTHEAST ASIA Final Study, Revised
Dec. 1969 65 p *Its* Spec. Study 105-11/1-Rev Supersedes N66-19776
(AD-700785) Avail: CFSTI CSCL 4/2

The report deals with the climate of North Vietnam, Republic of Vietnam, Laos, Cambodia, and Thailand for January. Essentially based on previously available data, however, precipitation analyses, ceiling, visibility, and upper air flow are new. Contains brief notes on the climate of Southeast Asia and the geographical features of the Republic of Vietnam, North Vietnam, Cambodia, Laos, and Thailand. Discusses the precipitation, thunderstorms, cloudiness, visibility and obstructions to vision, combined ceiling/visibility, temperature, relative humidity, surface and upper winds, miscellaneous phenomena and sea operations. Contains a station locator and topography map. Author (TAB)

N70-36398 National Lending Library for Science and Technology, Boston Spa (England).
ON THE DEPENDENCE OF MAXIMUM SUPERSATURATIONS AND THE CONCENTRATION OF DROPLETS FORMED IN A RISING AIR CURRENT ON THE SPECTRUM OF CLOUD NUCLEII
A. G. Laktionov et al 9 Apr. 1970 8 p refs Transl. into ENGLISH from Tr. Inst. Eksp. Met. (USSR), No. 6, 1969 p 10–15
(NLL-M-9082-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

Equations for calculating the supersaturation spectrum of cloud nuclei are derived and compared. Equations for droplet growth obtained by other authors and compared with the derived equations show a difference in the values of the numerical coefficients. Values are calculated for maximum supersaturation and droplet concentration in the atmosphere. R.B.

N70-36399 National Lending Library for Science and Technology, Boston Spa (England).
SPECIAL FEATURES OF THE WEATHER IN SUMMER 1968
Ju. S. Petrovskij 9 Apr. 1970 9 p Transl. into ENGLISH from Priroda (Moscow), no. 11, 1968 p 124–126
(NLL-M-9108-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

The distribution and anomalies of weather in the Northern Hemisphere during the summer of 1968 are discussed. The special features of weather over Europe and Siberia, the Far East, North America, and the tropic regions are considered. Author

N70-36436# Naval Postgraduate School, Monterey, Calif.
A NUMERICAL SIMULATION OF THE ADVECTIVE AND DIFFUSIVE TRANSFER OF TRACE SUBSTANCES IN THE STRATOSPHERE
Hugh Edward Willoughby (M.S. Thesis) Dec. 1969 48 p refs
(AD-706061) Avail: CFSTI CSCL 4/1

The numerical model which employs observed stratospheric winds to advect simulated tracers was developed. The model successfully reproduces many qualitative features of the observed fields of both ozone and radioactive debris. As the tracers evolve, the horizontal eddies constitute the principal process modifying the tracer zonal mean. Although the vertical eddies and the zonal mean cell are both an order of magnitude weaker than this process, the latter of these tends to always act in the same sense so that its effect becomes more important over long periods of time. Author (TAB)

N70-36448 National Lending Library for Science and Technology, Boston Spa (England).
COMPARATIVE MEASUREMENTS OF THE WATER CONTENTS OF CUMULUS CLOUDS WITH TWO INSTRUMENTS
I. V. Gryckiv et al 29 Apr. 1970 6 p refs Transl. into ENGLISH from Tr. Inst. Eksperim. Meteorol. (Moscow), v. 6, 1969 p 145–147
(NLL-M-9058-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupon

The results of simultaneous measurements of water content in cumulus clouds with the water content meter and ZAJCEV's instrument set up on an IL-14 aircraft are presented. Author

N70-36479 National Lending Library for Science and Technology, Boston Spa (England).
SOME FINDINGS ON THE FORMATION OF FOG AT L JUBL JANA-BRNIK AIRPORT
Mirko Kovach 2 Apr. 1970 8 p refs Transl. into ENGLISH from Drushtvo Met. Slov., Razprave (Ljubljana), no. 11, 1969 p 47–66
(NLL-M-9052-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupon

In the first part of the paper the percentage frequencies of visibility less than 1000 m for the 24 hours of the day and 12 months of the year are presented for Ljubljana-Brnik airport for the period 1964 to 1968. Some suggestions for forecasting the formation of radiation fog a few hours ahead are given as well. They are based on measurements of temperature and relative humidity in the thermometer screen (2 m) and on the control tower of the airport (25 m). Formation of fog can be predicted a few hours in advance by using temperature differences and relative humidity differences between the values in the screen and those on the control tower of the airport. Author

N70-36524+ Freie Univ., Berlin (West Germany). Inst. for Meteorology and Geophysics.
METEOROLOGICAL DATA. VOLUME 105, NO. 3: BERLIN READINGS: DIGITAL AND ANALOG RESULTS FROM THE CENTRAL MEASUREMENT REGISTRATION FACILITY

AND OTHER INSTRUMENTS FOR 1969, PART 3 Quarterly Report [METEOROLOGISCHE ABHANDLUNGEN. BAND 105, HEFT 3: BERLINER MESSWERTE: DIGITALE UND ANALOGE ERGEBNISSE DER ZENTRALEN MESSWERTREGISTRIERANLAGE UND WEITERER INSTRUMENTE FUER DAS JAHR 1969, TEIL 3, 3. VIERTELJAHR]

Richard Scherhag, Erich Wedler et al 1969 394 p In GERMAN (QR-3-Pt-3) Avail: CFSTI

Digital and analog measurements on atmospheric radiation, electric fields, back radiation, and global radiation were corrected for dew formation as well as for precipitation caused errors. Climatological measurements were performed during the period July through September, 1969. Transl. by G.G.

N70-36532+ Freie Univ., Berlin (West Germany). Inst. for Meteorology and Geophysics.

METEOROLOGICAL DATA. VOLUME 106, NO. 4: DAILY ALTITUDE MAPS OF THE 100 mb LEVEL AND THE 50 mb LEVEL AS WELL AS MONTHLY MEAN MAPS FOR 1969, PART 4 Quarterly Report [METEOROLOGISCHE ABHANDLUNGEN. BAND 106, HEFT 4: TAEGLICHE HOEHENKARTEN DER 100-MB-FLAECHE UND DER 50-MB-FLAECHE SOWIE MONATLICHE MITTELKARTEN FUER DAS JAHR 1969. TEIL 4, 4. VIERTELJAHR]

Barbara Kriester, Karin Labitzke, Renate Lenschow, Wolfgang Roeder, Richard Scherhag et al 1969 128 p In GERMAN (QR-4-Pt-4) Avail: CFSTI

Median-, anomalous-, and changing weather maps are presented for the Northern Hemisphere for the period September through December, 1969. Observed were atmospheric pressure, temperature, and heights of the 100 mb level and the 50 mb level. Transl. by G.G.

N70-36593*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

TEMPERATURE, PRESSURE, DENSITY, AND WIND MEASUREMENTS IN THE STRATOSPHERE AND MESOSPHERE

W. S. Smith, J. S. Theon, J. F. Casey (Globe Universal Sciences), and J. J. Horvath (Michigan Univ.) Washington Aug. 1970 80 p refs

(NASA-TR-R-340; G-980) Avail: CFSTI CSCL 04B

Data from 36 rocket soundings conducted during 1968 from Wallops Island, Virginia; Churchill, Canada; Barrow, Alaska; Natal, Brazil; and Arecibo, Puerto Rico are presented. Temperature, pressure, density, and wind profiles from 30 acoustic grenade experiments and temperature, pressure, and density profiles from 6 pitot probe experiments covering the altitude range of approximately 30 to 90 km are tabulated. No attempt is made to analyze the meteorological significance of these data. The results of error analyses for each of the 30 acoustic grenade soundings are included. Author

N70-36628 National Lending Library for Sicence and Technology, Boston Spa (England).

ON THE GROWTH OF DROPLETS BY CONDENSATION ON HYGROSCOPIC NUCLEI

E. L. Aleksandrov et al 8 Apr. 1970 9 p refs Transl. into ENGLISH from Tr. Inst. Eksperiment. Met. (USSR), no. 6, 1969 p 16-96

(NLL-M-9080-(5828.4F)) Avail: Natl. Lending Library, Boston, Spa, Engl.: .1 NLL photocopy coupons

Droplet growth by condensation on hygroscopic nuclei was calculated for dilute solution droplet growth with no soluble solid matter. Sodium chloride was chosen as a hygroscopic substance, with quartz as the insoluble part of the nucleus. Sodium chloride concentration effects on the solution surface tension are described mathematically. Initial droplet radius values for dry nucleus initial radii and dissolved matter concentrations at 20 C are given. The growth of droplets on hygroscopic nuclei is appreciable even at humidities of 80 to 90 percent. Nuclei radii can increase by a factor of two or three and produce changes in atmospheric optical properties even when the necessary conditions for cloud and fog formation are absent. Sudden deterioration of visibility associated with mist formation may be due to this phenomenon. Small changes in relative humidity can play a significant role in the subsequent growth by condensation of 0.5 to 1 micron nuclei. This phenomenon can distort measurement results in diffusion chambers. J.M.

N70-36627 National Lending Library for Science and Technology, Boston Spa (England).

THE EFFECT OF THE JOINING OF SNOW CRYSTALS TO FORM SNOWFLAKES ON THE RATE AT WHICH THEY GROW BY CONDENSATION

I. V. Litvinov 8 Apr. 1970 8 p refs Transl. into ENGLISH from Tr. Inst. Eksperiment. Met. (USSR), no. 6, 1969 p 142-144

(NLL-M-9088-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

The magnitude and sign of mass change when single snow crystals combine to form flakes is estimated mathematically. Equations based on experimental data are given for particle density related to diameter and particle fall speed related to equivalent diameter. Results show that the mass rate, when snow crystals coagulate to snow flakes, can increase or decrease, and therefore the aggregation of crystals can be neglected in calculations of growth by condensation. J.M.

N70-36639*# Israel Program for Scientific Translations, Ltd., Jerusalem.

PROBLEMS OF SATELLITE METEOROLOGY [VOPROSY SPUTNIKOVOI METEOROLOGII]

I. P. Vetlov et al, ed. 1970 106 p refs Transl. into ENGLISH of Tr. Gidrometeorol. Nauchn.Issled. Tsentr. SSSR (Leningrad), no. 36, 1968 Sponsored by ESSA and NSF

(TT-70-50001) Copyright. Avail: CFSTI

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N70-36640# Israel Program for Scientific Translations, Ltd., Jerusalem.

USE OF CLOUD DATA OBTAINED BY METEOROLOGICAL SATELLITES FOR AN OBJECTIVE ANALYSIS OF THE WIND FIELD

L. A. Anekeeva *In its* Probl. of Satellite Meteorol. 1970 p 1 - 6 refs (See N70-36639 20-20)

Copyright. Avail: CFSTI

The interrelationship between cloud fields shown by satellite television, and air currents in the presence of cloud vortices is examined. Quantitative estimates are made of the angle between the direction of the cloud band forming the vortex and the wind direction in the same regions. The vortices are compared by means of a relative coordinate system and relative linear dimensions, on the assumption that the shape of cloud spirals is near-hyperbolic. The region occupied by the cloud vortex is divided into 40 parts (8 sectors and 5 sections along the vortex radius), for each of which histograms of the distribution angle between the cloud-band direction and the wind direction at a station are constructed. It was established that the values of this angle obey a near-normal distribution. The most probable values of this angle obtained for each cloud vortex segment make it possible to determine the wind direction at any point of the cloud-vortex region. The relationships obtained in the above manner were used to calculate the wind field by means of an objective analysis, using polynomial interpolation. Author

N70-36641# Israel Program for Scientific Translations, Ltd., Jerusalem.

DETERMINATION OF THE JET-STREAM AXIS FROM SATELLITE CLOUD DATA

T. D. Dzyubenko et al *In its* Probl. of Satellite Meteorol. 1970 p 7 - 12 refs (See N70-36639 20-20)

Copyright. Avail: CFSTI

The possibility is examined of determining the location of a jet-stream axis from properties of the cloud field, the mutual location of the cloud cover and the jet-stream axis. The average wind velocities and horizontal wind gradients along and perpendicular to the axis were determined at jet-stream sections, determined by means of television (TV) pictures of cloudiness. It is noted that jet-stream segments located in the forward part of the altitudinal trough are most frequently surveyed on TV pictures. The cloud mass of the jet stream is located primarily on the warm side and its boundary facing the cold side in 72% of the cases coincides with the jet-stream axis. The mean velocity at characteristic points of the jet-stream axis ranges from 44 to 52 m/sec; the wind shear in the direction perpendicular to the jet-stream axis is 7.6 m/sec from the cold side and 6.2 m/sec from the warm side per 100 km. Author

N70-36642# Israel Program for Scientific Translations, Ltd., Jerusalem.

THE CLOUDINESS STRUCTURE IN CYCLONES IN SOUTHERN EUROPEAN USSR FROM SATELLITE PHOTOGRAPHS

T. P. Popova *In its* Probl. of Satellite Meteorol. 1970 p 13 - 19 refs (See N70-36639 20-20)

Copyright. Avail: CFSTI

The cloud-field structure determined by air-motion parameters can yield indirect indications of atmospheric processes Structural features of the cloud field from television photographs taken by a satellite, which are characteristic of cyclones forming over southern European USSR are considered. Author

N70-36643# Israel Program for Scientific Translations, Ltd., Jerusalem.

SHADOW ON SATELLITE PHOTOGRAPHS AS A SOURCE OF INFORMATION ON THE HEIGHT OF CLOUDS

M. Nazirov *In its* Probl. of Satellite Meteorol. 1970 p 20 - 25 (See N70-36639 20-20)

Copyright. Avail: CFSTI

Before the shadow on satellite photographs can be used to determine the vertical extent of clouds, correction factors, which depend on the distance between the shadow on the picture and the sub-satellite point during photography, must be introduced. Such an adjusted shadow width, together with the calculated elevation of the sun in the region of the shadow, are used to graphically determine the height of cirrus cloud bands on a picture obtained from the Cosmos-206 satellite. Author

N70-36644# Israel Program for Scientific Translations, Ltd., Jerusalem.

THE INTERTROPICAL CONVERGENCE ZONE IN THE EASTERN PACIFIC FROM METEOROLOGICAL SATELLITE OBSERVATIONS

I. A. Alekseeva *In its* Probl. of Satellite Meteorol. 1970 p 26 - 34 refs (See N70-36636 20-20)

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The spatial structure of the cloud field in the eastern part of the tropical Pacific with the aid of satellite observations during 1967 is examined. The possibility is considered of identifying the intertropical convergence (ITC) zone with cloud fields. The position of this zone is given according to months. In the Northern Hemisphere it is quite stable throughout the year. In the Southern Hemisphere, from mid-February to May, one observes an ITC zone with a branch extending to the north of the equator. Consideration is given to the internal structure of the ITC zone, i.e., its cellular structure, characteristic horizontal dimensions, and space and time variations. It is shown that meteorological satellite information which is continuous in space, is an important supplement when analyzing atmospheric processes in tropical latitudes. Author

N70-36645# Israel Program for Scientific Translations, Ltd., Jerusalem.

FEATURES OF ATMOSPHERIC FRONTS IN THE SOUTHERN HEMISPHERE FROM SATELLITE OBSERVATIONS

I. R. Egorova *In its* Probl. of Satellite Meteorol. 1970 p 35 - 38 refs (See N70-36639 20-20)

Copyright. Avail: CFSTI

Some features of fronts in the South Pacific for March - April 1967 using satellite radiation data are considered. Average and extremal values are presented of the radiation characteristics in the region of the front for two latitudinal belts and for a number of specific frontal zones. Zones with reduced radiation temperatures in the given region, which is about 650 km wide, often occur. The mean rates of their motion at low and high altitudes are given. The presence of intensive transport of air masses between latitudes in the 150 - 160 deg region is confirmed. It is shown that the relative intensities of frontal interfaces can be determined from radiation characteristics. Author

N70-36646# Israel Program for Scientific Translations, Ltd., Jerusalem.

RELATIONSHIP BETWEEN CLOUD MASSES OBSERVED

FROM A SATELLITE AND THEIR PRECIPITATION ZONES

E. P. Dombkovskaya *In its* Probl. of Satellite Meteorol. 1970 p 39–45 refs (See N70-36639 20-20)
Copyright. Avail: CFSTI

The provision of information for the national economy, in particular aviation, as well as solving certain applied problems requires knowing the areas occupied by cloud systems and their precipitation zones. A ground network of stations located far apart cannot provide data on the cloudiness distribution over regions where there are no stations. With the advent of meteorological satellites, the cloudiness distribution over these regions could also be studied. The results of studies using TIROS IX and TIROS X data, and those obtained at ordinary meteorological stations are presented. The available data show that, in general (79.8%), precipitation originates from cloudiness, denoted on nephelometer charts as continuous. As a rule, precipitation zones occupy a relatively small proportion of cloud masses (in 87.2% of the cases the precipitation-zone area occupied less than one third of the cloud mass area) and are distinguished by a great time variability. A sufficiently close correlation exists between cloud-mass size and its precipitation zone (the correlation factor being 0.70). On the average, the larger the cloud mass, the smaller is the proportion occupied by the precipitation zone. Author

N70-36647# Israel Program for Scientific Translations, Ltd., Jerusalem.

USE OF METEOROLOGICAL-SATELLITE DATA AS A NAVIGATION AID

K. P. Vasilev *In its* Probl. of Satellite Meteorol. 1970 p 46–57 refs (See N70-36639 20-20)
Copyright. Avail: CFSTI

The use of satellite data as a navigation aid is considered, and methods for interpreting satellite television pictures of sea ice and the difficulties encountered in this work are described. The significance of climatic data in interpreting satellite photographs and the establishment of ice charts from satellite photographs are discussed. An example is presented of supplying ice information, obtained from satellite data, to the survey vessel Professor Vize. The problem of selecting photographs of cloud vortices to determine zones of gale-force swells in the ocean as a function of the cyclone development stage is considered in detail. Author

N70-36648# Israel Program for Scientific Translations, Ltd., Jerusalem.

A QUALITATIVE ANALYSIS OF SATELLITE INFRARED DATA

E. V. Dzyubenko et al *In its* Probl. of Satellite Meteorol. 1970 p 58–74 refs (See N70-36639 20-20)
Copyright. Avail: CFSTI

The possibility of determining the radiating-surface temperature and altitude of an upper cloud boundary using infrared equipment of Meteor satellites is considered. The effect of water vapor and ozone on outgoing radiation at the 8–12 micron atmospheric window is studied qualitatively. Relationships are obtained for the deviation of the radiation temperature from the actual temperature of radiating surfaces located at altitudes of 0, 2, 4, 6 and 8 km. Calculations based on experimental data show that, using satellite infrared equipment, the underlying surface temperature can be determined to within 1.5–2.0 deg and the altitude of the upper cloud boundary to within 1.0–1.5 km. It is pointed out that a quantitative analysis of infrared information from Meteor satellites can be carried out in operative times. Author

N70-36649# Israel Program for Scientific Translations, Ltd., Jerusalem.

CORRELATION FUNCTIONS AND SPECTRAL DENSITIES OF THE INTENSITY OF OUTGOING RADIATION OVER THE SPECTRAL RANGE 0.6–0.8 MICRONS (FROM MEASUREMENTS OF THE COSMOS-45 SATELLITE)

V. G. Boldyrev et al *In its* Probl. of Satellite Meteorol. 1970 p 75–80 refs (See N70-36639 20-20)
Copyright. Avail: CFSTI

Results are presented of calculations of autocorrelation functions and spectral densities of reflected radiation over the spectral range 0.6–0.8 micron. The calculations were based on measurements obtained for the Cosmos-45 satellite, which used nonscanning, narrow-viewing angle apparatus with its sensor directed into the nadir. The effect on the instrument readings of changes in illumination was eliminated by the use of moving averages. The results confirm the presence of a deep, mesoscale minimum in the spatial spectrum of reflected radiation, and of a maximum corresponding to the characteristic dimension of synoptic formations (cyclones and anticyclones). Author

N70-36650# Israel Program for Scientific Translations, Ltd., Jerusalem.

ANALYSIS OF STUDIES OF LARGE-SCALE VERTICAL MOTIONS IN THE ATMOSPHERE

G. I. Morskoi *In its* Probl. of Satellite Meteorol. 1970 p 81–101 refs (See N70-36639 20-20) Copyright. Avail: CFSTI

The development of satellite meteorology as a new branch of the meteorological sciences is closely related to the determination of large-scale vertical velocities. Vertical velocities are not actually measured (although some attempts have been made in this direction), and many methods have been developed for their calculation, often yielding different results. Comparative evaluation and classification of 200 works were made. Author

N70-36759# Finnish Meteorological Office, Helsinki.

HEAT BALANCE OF THE EARTH'S SURFACE AT JOKIOINEN (60.8 DEGREES N, 23.5 DEGREES E), SUMMER 1968

Antti Kulmala 1970 69 p refs Sponsored by the Finish Academy of Sciences and the Finnish Cultural Foundation
(NO-74) Avail: CFSTI

Variations of the components of the heat balance equation based on microclimatological observations made in summer 1968, are discussed. The comparisons showed that the best method of calculating latent and sensible heat flux is Hogstrom's bulk aerodynamical method, which accounts for variations of stability when calculating exchange coefficients. Roughly 2/3 of the net radiation was converted into evaporation, 1/4 into sensible heat, and the rest into soil heat. The combination of methods shown to be best by the comparisons does not satisfy the balance equation exactly; a systematic error is found, indicating a loss of heat from the earth's surface. The probable reason for this is excessive evaporation values. The data-logging system used proved to be satisfactory. Its greatest advantage is that it enables vast quantities of observations to be handled within a reasonable time. Author

N70-36781 Meteorological Office (Gt. Brit.)

AVERAGE TEMPERATURES, CONTOUR HEIGHTS AND WINDS AT 50 MILLIBARS OVER THE NORTHERN HEMISPHERE

R. A. Ebdon 1970 109 p refs *Its* Geophys. Mem. 112, No. 2, Vol. 15
(MET-O-808b) Copyright. Avail: HMSO £3 10s; BIS $12.60

The charts are based upon observations made within the five-year period 1957-61 by radiosonde and radar wind-finding equipment. All available ascents, irrespective of hours of observation, were used in the computation of the averages and standard deviations. As the period included the International Geophysical Year and the subsequent period of the International Geophysical Cooperation, data from two radiosonde ascents per day were available for many areas from July 1957 to October 1959 but for the remainder of the period published data for only one ascent per day were readily available for many countries. Author

N70-36833 Freie Univ., Berlin (West Germany). Inst. for Meteorology and Geophysics.
METEOROLOGICAL DATA. VOLUME 102, NO. 4: DAILY GROUND- AND 850-mb-MAPS OF THE NORTHERN HEMISPHERE FOR 1969, PART 4 Quarterly Report [METEOROLOGISCHE ABHANDLUNGEN. BAND 102, HEFT 4: TAEGLICHE BODEN- UND 850-mb-KARTEN DER NORDHEMISPHAERE IM JAHRE 1969. TEIL 4, 4. VIERTEL JAHR]
Manfred Geb, Richard Scherhag et al 1969 199 p In GERMAN
(GR-4-Pt-4) Avail: Issuing Activity

Presented are daily ground- and 850 mb charts of the Northern Hemisphere for the period October through December, 1969. Transl. by G.G.

N70-36885# Weapons Research Establishment, Salisbury (Australia).
THE VARIATION OF AIR TEMPERATURE IN THE FIRST 150 FT OF THE ATMOSPHERE AT WOOMERA
M. S. Brown Aug. 1969 63 p refs
(WRE-TN-OSD-105) Avail: CFSTI

From August 1967 to March 1969 thermoelectric equipment was used to measure the air temperature and temperature gradient on a 150 ft mast at Woomera. Measurements made in this period are presented graphically and in tabular form for each two hours of the day. Author

N70-36931# Commonwealth Scientific and Industrial Research Organization, Sydney (Australia). Div. of Radiophysics.
CLOUD SEEDING WITH PYROTECHNICS IN AUSTRALIA
E. J. Smith 1970 4 p refs Presented at the Am. Meteorol. Soc. 2d Natl. Conf. on Weather Modification, Santa Barbara, Calif. 6-9 Apr. 1970
Avail: CFSTI

Experiments are described in which pyrotechnic cartridges were fired into large cumulus clouds in Australia. The objective was to make preliminary observations of events following seeding. Statistical evaluation was not attempted at this stage. Author

N70-36941*# Lockheed-California Co., Burbank. Physical and Life Sciences Lab.
A FURTHER STUDY OF JIMSPHERE WIND PROFILES AS RELATED TO SPACE VEHICLE DESIGN AND OPERATIONS
S. I. Adelfang, A. Court, C. A. Melvin, and M. Pazirandeh Washington NASA Aug. 1970 85 p refs
(Contract NAS8-30165)
(NASA-CR-1640; LR-23535) Avail: CFSTI CSCL 04B

Statistical characteristics of steady state winds, gusts, and wind shears observed over Cape Kennedy, Florida, and Point Mugu, California, with Jimsphere balloon sensors are described. Gusts in Jimsphere wind profiles as viewed in the time coordinates of a Saturn vehicle were isolated from the original profiles with a 33 weight digital high pass filter with negligible transmission of wind fluctuations at frequencies less than 0.15 cps. A preliminary study of a method for mathematical representation of observed gust functions suggests that the method can be applied to Jimsphere wind profiles that are closely spaced in time. A study of the climatological means and standard deviations of the magnitude of the vector shear at altitudes of 8 and 15 km indicates that they can be described by power law functions of layer thickness that are nearly alike for Cape Kennedy and Point Mugu, but are significantly different from those derived from a few summer profiles by other workers. A method for profile sampling is developed which provides profile sample sets that represent 5 critical characteristics of the parent population. A test of the method consisting of a comparison of the distributions of spectrum densities between 0.3 and 3.0 cps of 5 sample sets, each composed of 25 profiles, to the corresponding distributions of the entire population indicates that the spectrum distributions of any of the 5 sample sets offer a fair approximation to that of the whole 900 profile parent population. Author

N70-36953*# National Aeronautics and Space Administration, Washington, D.C.
WIND LOADS DURING ASCENT
Jun. 1970 36 p refs
(NASA-SP-8035) Avail: CFSTI CSCL 01A

The determination of wind-induced structural loads on a space vehicle during ascent is considered. Models of the wind environment are described and analytical procedures are outlined for utilizing these models with the space vehicle properties and trajectory parameters to calculate the wind-induced loads. The wind models are synthesized from measured natural wind-environment data for each of the four major launch sites used by NASA. Author

N70-37126# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
EVALUATION OF THE DIFFUSION OF GAS WASTES IN THE FREE ATMOSPHERE FROM A CONTINUOUS POINT SOURCE: GRAPHS AND COMMENTARY [EVALUATION DE LA DIFFUSION D'EFFLUENTS GAZEUX EN ATMOSPHERE LIBRE A PARTIR D'UNE SOURCE PONCTUELLE CONTINUE: ABAQUES ET COMMENTAIRES]
Robert Le Quinio Feb. 1970 24 p refs In FRENCH; ENGLISH summary
(CEA-R-3945) Avail: CFSTI

Very simplified graphs are presented for evaluating the consequences of effluent release. Numerous experimental releases were used to establish these graphs. The proposed low values and the rejection of fundamental parameters e.g. wind speed, temperature gradient, is justified with comments and references. The way in which diffusion coefficients may be influenced by exposure time is stressed. Author (ESRO)

N70-37140 World Meteorological Organization, Geneva (Switzerland).
DEVELOPMENT OF THE WWW OCEANIC OBSERVING SUB-SYSTEM FOR 1972–1975
1970 107 p refs *Its* World Weather Watch Planning Rept. No. 31
Copyright. Avail: WMO, Geneva: Sw. Fr. 10

This report summarizes observational requirements as regards the accuracy, spacing and frequency of data to be effective during the period 1972–1975 for the World Weather Watch (WWW). The five types of vehicle for electron, and scanning electron microscopy were used to examine the topography of the films produced, and X-ray WWW are reviewed. This leads to a consideration of the integrated subsystem observing sub-system in which the following five components are further examined: (a) ships, (b) aircraft, (c) satellites, (d) superpressure balloons, (e) buoys. Requirements for the period 1976–1979 are also considered. Author (ESRO)

N70-37161# Environmental Science Services Administration, Silver Spring, Md. Techniques Development Lab.
COMPUTER-PRODUCED WORDED FORECASTS
Harry R. Glahn Jun. 1970 12 p refs
(ESSA-TM-WBTM-TDL-32) Avail: CFSTI

Examples of worded weather forecasts prepared entirely by computer are presented. Forecasts of the individual elements are produced objectively with input from the PE and SAM models used operationally at the National Meteorological Center. Possibilities for the use of automated worded forecasts are discussed. Author

N70-37159# Environmental Science Services Administration, Silver Spring, Md.
NUMERICAL WEATHER PREDICTION ACTIVITIES: NATIONAL METEOROLOGICAL CENTER, FIRST HALF OF 1970
Jul. 1970 39 p
Avail: Issuing Activity

Forecast verifications and activities in data automation, extended forecasting and analysis, and instrument and model development are presented. Weather maps for the verifications and monthly means of verifications for 1970 are given. N.E.N.

N70-37167# Chicago Univ., Ill. Dept. of the Geophysical Sciences.
MESOSCALE MODIFICATION OF SYNOPTIC SITUATIONS OVER THE AREA OF THUNDERSTORMS' DEVELOPMENT AS REVEALED BY ATS 3 AND AEROLOGICAL DATA
Kozo Ninomiya (Meteorol. Res. Inst.) Apr. 1970 44 p refs
(Grants ESSA-E-198-68(G); ESSA-E22-4-69(G))
(SMRP-RP-85) Avail: CFSTI

Synoptical and dynamical aspects of the development of the tornado-producing thunderstorms of April 23, 1968 were studied by combining conventional observation data with ATS 3 pictures, with special emphasis on the interaction between the thunderstorms and large-scale field. Results of the analysis reveal a significant modification of moisture, thermal, and wind fields in the vicinity of the area where storms developed. The formations of the large-scale cloud band and moist tongue are due to the mesoscale convective disturbances that developed along the frontal zone. It is concluded that the formation of a mid-tropospheric warm core accompanied by a strong upper outflow is the result of a process of so-called convective warming. Results of the analyses suggest that both the jet stream and the core of positive vorticity to the left of the jet stream are formed by the increased thermal gradient to the left of the warm core. It is inferred that the modified thermal field and vorticity field force downward motion and produce the dry area to the rear of the storm area. Author

N70-37218# Miami Univ., Coral Gables, Fla. Inst. of Marine and Atmospheric Sciences.
A SYNOPTIC METEOROLOGICAL STUDY FOR THE EASTERN CARIBBEAN AREA, 10–25 July 1967
Jose J. Fernandez-Partagas Sep. 1969 45 p refs
(Grant ESSA-E22-29-69(G))
(PB-190017) Avail: CFSTI CSCL 04B

The objective of this work is to estimate the wind distribution with height near individual clouds at their time of observation by the ESSA Experimental Meteorology Branch over the eastern Caribbean Sea in July 1967. In addition to the multiple-level streamline analysis performed to satisfy the above objective, large-scale variations in temperature, humidity and cloudiness were studied. Examination of these quantities permitted a description of the evolution of synoptic-scale features affecting the eastern Caribbean area during July 10–25, 1967. Three out of the four observed tropical disturbances showed a closed cyclonic circulation at some upper levels and a wave perturbation at lower, mid-tropospheric levels; the fourth system was a very strong wind surge embedded in a deep easterly current. Author (USGRDR)

N70-37247# Miami Univ., Coral Gables, Fla. Inst. of Marine and Atmospheric Sciences.
THE MEAN CIRCULATION, SYNOPTIC DISTURBANCES AND RAINFALL PATTERNS OVER SOUTH FLORIDA AND ADJACENT AREAS IN MAY 1968
Jose J. Fernandez-Partagas Oct. 1969 83 p refs
(Grant ESSA-E22-29-69(G))
(PB-190018) Avail: CFSTI CSCL 04B

A meteorological study is presented for south Florida and adjacent areas for the month in May 1968, with particular emphasis on the May 16-31 period. The motivation for this study is the ESSA Experimental Meteorology Branch cloud seeding experiments over south Florida during the second half of May 1968. Several circulation and rainfall patterns are thoroughly discussed. It is found that the highly disturbed weather conditions over south Florida in May 1968, especially during the last third of that month, were associated with specific large scale features which acted not only as rain-producing systems but also as invigorating mechanisms for the convective cycle over large land masses. Author (USGRDR)

N70-37267# Texas Univ., Austin. Antennas and Propagation Div.
DETECTION AND ANALYSIS OF CLEAR AIR TURBULENCE USING RADAR AND OTHER SENSORS
Allen B. Plunkett, A. P. Deam, and Alfred H. La Grone 20 Jan. 1970 113 p refs
(Grants NSF GA-772; NSF GA-11462)
(PB-190130; P-40) Avail: CFSTI CSCL 04B

It is generally known that a region of clear air turbulence will many times have associated with it a sufficient amplitude of disturbed refractive index to allow detection by radar. The objectives of this study are to determine the characteristics of the radar return associated with a region of disturbed refractive index, and the relationship between the magnitudes of the mechanical turbulence and the disturbed refractive index. These objectives are accomplished by using airplane carried refractometers, temperature sensor, and accelerometer to examine locally the regions in question at the same time as the radar is operating. Author (USGRDR)

N70-37271# Environmental Data Service, Silver Spring, Md.
GUIDE TO SOVIET LITERATURE ACCESSIONS IN THE ATMOSPHERIC SCIENCES LIBRARY AND THE GEOPHYSICAL SCIENCES LIBRARY, JANUARY–FEBRUARY 1970
Feb. 1970 97 p Transl. into ENGLISH from Russian publ.
(PB-190007T; ESSA-TM-WB-TA-24) Avail: CFSTI CSCL 04B

The guide to Soviet literature accessions contains literature on meteorology and related sciences. USGRDR

N70-37272# Weather Bureau, Fort Worth, Tex. Southern Region Headquarters.
A REASSESSMENT OF THE HURRICANE PREDICTION PROBLEM
Robert H. Simpson Feb. 1970 20 p refs Presented at AMS Tech. Conf., Miami Beach, Fla., 12 Feb. 1969
(PB-188646; ESSA-TM-WBTM-SR-50) Avail: CFSTI CSCL 04B

The paper presents an assessment of the hurricane prediction problem from the perspective of the hurricane forecaster trying to identify sources of error, and searching for more objective means of making forecast decisions. Author (USGRDR)

N70-37312# Environmental Science Services Administration, Asheville, N.C.
HIGH ALTITUDE METEOROLOGICAL DATA, VOLUME 8, NO. 1, JANUARY 1970
1970 247 p
Avail: GOD $3.00

Wind and temperature measurements from all available meteorological rocket firings are presented, along with computed values for pressure, density, and speed of sound. Local radiosonde observations nearest the time of firing are included. Author

N70-37325# Aerometric Research Inc., Goleta, Calif.
LARGE SCALE DYNAMIC EFFECTS OF CLOUD SEEDING Final Report
Keith J. Brown and Robert D. Elliott Dec. 1969 126 p refs
(Contract DI-14-06-D-5963)
(PB-189658) Avail: CFSTI CSCL 04B

The report covers a three and one half year study of the large scale effects of cloud seeding. Included in this program was a statistical analysis of four long term operational cloud seeding projects and two randomized research type projects and finally a pilot field program to test the hypotheses developed in the statistical phase of the contract. The statistical analysis of past operational and research seeding projects showed considerable evidence that areas 70 to 150 miles downwind from the nuclei source were receiving increased precipitation during cloud seeding operations. In many cases the increases in the downwind area was equal or greater than those in the intended target areas. A field program conducted during the 1968-69 winter season essentially confirmed this finding. Author (USGRDR)

N70-37371# National Severe Storms Lab., Norman, Okla. Research Labs.
ON THE RELATIONSHIP BETWEEN HORIZONTAL MOISTURE CONVERGENCE AND CONVECTIVE CLOUD FORMATION
Horace R. Hudson Mar. 1970 42 p refs
(PB-191720; ESSA-TM-ERLTM-NSSL-45) Avail: CFSTI CSCL 04B

A technique suggested by H. L. Kuo for parameterizing the net effect of the latent heat released by cumulus convection on large scale flow is evaluated to determine its applicability to regions of convection in middle latitude severe storm stiuations. The ratio of the integrated horizontal moisture divergence to a measure of moisture required for the development of a model cloud is interpreted as the amount of model cloud produced in a given time. The model cloud is characterized by pseudo-adiabatic temperature and moisture profiles above the lifting condensation level. The technique uses regularly available rawinsonde data and is performed using computer techniques. Results suggest that well-defined axes of horizontal moisture convergence generally accompany development of strong cumulus convection and that the use of a pseudo-adiabatic cloud to model the moisture requirements generally gives a reasonable amount of predicted cloud formation. The patterns of predicted cloud formation often correlate well with observed radar patterns of strong cumulus convection. Author (USGRDR)

N70-37384# Environmental Data Service, Silver Spring, Md.
APPLICATION OF AIR-MASS CLASSIFICATIONS TO WEST VIRGINIA CLIMATOLOGY
Robert O. Weedfall Jan. 1970 29 p refs
(PB-191966; ESSA-TM-EDSTM-13) Avail: CFSTI CSCL 04B

Percentages of various types of air masses occurring over West Virginia and their origins for the summer and winter seasons were developed in tabular form and illustrated on maps of the North American continent. Air-mass percentages were largely developed from a Pennsylvania study, subjectively adjusted for West Virginia. The history of air-mass classification systems are outlined, the difficulties and limitations of any type of system noted, and the various applications of recent methods are reviewed. Author (USGRDR)

N70-37408# General Research Corp., Santa Barbara, Calif.
A MODELING STUDY TO CHARACTERIZE PHOTOCHEMICAL ATMOSPHERIC REACTIONS TO THE LOS ANGELES BASIN AREA Final Report
A. Q. Eschenroeder and J. R. Martinez Nov. 1969 74 p refs
(Contract PHS-CPA-22-69-127)
(PB-189074; GRC-CR-1-152) Avail: CFSTI CSCL 07E

Chemical kinetics and atmospheric transport processes are combined in a finite difference formulation to compute concentration histories for photochemical smog. The kinetics are expressed as a lumped parameter reaction mechanism which was derived from laboratory data in the literature. Diffusion coefficients, which depend on height and time, come from atmospheric measurements. Inputs consist of source inventories for the Los Angeles basin and the solar irradiation curves for the appropriate days. Predicted time histories of reactive hydrocarbons, oxides of nitrogen and ozone are consistent with the variations observed at an air monitoring station. Author (USGRDR)

N70-37409# Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
PROJECT SKYWATER: SUMMARY AND CONTRACTOR REPORTS Annual Report, 1969
Mar. 1970 490 p refs
(PB-183017; REC-OCE-70-13) Avail: CFSTI CSCL 04B

The report presents the fiscal year 1969 activities and accomplishments of the Bureau of Reclamation's atmospheric water resources program. The objective of this weather modification program is to provide precipitation management technology for use in solving the nation's water resources problems. A short introductory section summarizes activities in the categories of winter field programs, summer field programs, nonfield programs, and pilot projects. The bulk of the document consists of reports prepared by Bureau of Reclamation contractors in which they summarize their FY 1969 activities. Author (USGRDR)

N70-37460# National Hurricane Research Lab., Miami, Fla.
A DIAGNOSTIC MODEL OF THE TROPICAL CYCLONE IN ISENTROPIC COORDINATES
Richard Allen Anthes Apr. 1970 164 p refs
(PB-191736; ESSA-TM-ERLTM-NHRL-89) Avail: CFSTI CSCL 04B

A diagnostic axisymmetric model in isentropic coordinates is developed to study the effects of differential heating on the dynamics and energetics of the steady-state tropical cyclones. From the thermal forcing specified by various heating distributions, slowly varying solutions for the mass and momentum fields are obtained by an iterative technique. The theory of available potential energy for open systems is utilized to study the energy budget for the hurricane. The conversion of available potential to kinetic energy closely follows the generation of available energy as the slowly varying state is reached. Horizontal and vertical mixing are studied through the use of constant exchange coefficients. As the internal mixing is decreased, the maximum surface wind increases and moves closer to the center. USGRDR

N70-37517# Chicago Univ., Ill. Dept. of the Geophysical Sciences.
AXISYMMETRIC FLOWS IN THE BOUNDARY LAYER OF A MAINTAINED VORTEX
H. L. Kuo 30 Apr. 1969 90 p refs
(Grants ESSA-E-259-69(G); NSF GA-1339)
(PB-191223) Avail: CFSTI CSCL 04A

A set of exact solutions of the axial symmetric Navier-Stokes equations was obtained which yields a jet along the axis and a common vortex motion when fluid endowed with circulations is let in across the rim and let out through an opening at the center. When the flow along the boundaries is taken into consideration, the solutions also give rise to a narrow but strong counter current along the edge of the jet. The three-dimensional flows in the boundary layer of a common vortex, from the core region of nearly solid rotation to the outer region of potential vortex, are obtained by solving the two relevant non-linear boundary layer equations in two directions alternatingly, first for the radial variations and then for the vertical variations. Author (USGRDR)

N70-37550# Commerce Dept., Washington, D.C.
WORLD WEATHER PROGRAM PLAN FOR FISCAL YEAR 1971 Message from the President of the United States, Apr. 1970
GPO Apr. 1970 35 p Presented to 91st Congr., 2d Sess., Apr. 1970
Avail: SOD $0.50

The efforts to bring about improved weather services through international cooperation are discussed. Significant events related to world weather during 1969 are highlighted. The World Weather Program and its goals are described and specific information on relevant U.S. programs is presented. A fiscal summary of the various programs is provided. Author

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N70-36281# Army Electronics Command, Fort Monmouth, N.J.
OMEGA PROCESSOR
Irving Levine Jan. 1970 13 p ref
(AD-703118; ECOM-3223) Avail: CFSTI CSCL 17/7

An OMEGA processing system was investigated to determine the minimum averaging time that could be obtained with output variations that are not excessive. The processing system involved used sample and hold type circuits. A significant reduction in the response time (an order of magnitude) of the OMEGA receivers over those presently available was attained and useful position information was provided. Author (TAB)

N70-36343*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
A CONCEPTUAL STUDY OF THE SSV/GN AND C SYSTEM DATA BUS
G. E. Proch 22 May 1970 180 p refs
(Contract NAS9-5191)
(NASA-CR-108588; LEC/HASD-643D-21-844) Avail: CFSTI CSCL 17G

The development of a time-shared data bus concept compatible with the space shuttle vehicle (SSV) guidance, navigation and control system functional and operational requirements is reported. The concept evolves from discussion, tradeoffs, and analysis presented under three basic subjects: system data requirements, data management considerations, and data communication techniques. Data requirements for the SSV mission are estimated. Data classes are developed to facilitate their management and transfer. Communication techniques are evaluated to obtain an acceptable data reliability for a minimum hardware constraint. Specific recommendations of data bus features and technical characteristics are stated. A data bus interface assembly is proposed. Author

N70-36438# Naval Postgraduate School, Monterey, Calif.
A REAL TIME SIMULATION OF A HUMAN-CONTROLLED, COMMAND-GUIDED AIR-TO-SURFACE MISSILE
Robert Stephen Erb (M.S. Thesis) Jun. 1969 120 p refs
(AD-706052) Avail: CFSTI CSCL 16/4

The paper investigates the feasibility of an air-to-surface missile delivery system employing impact prediction to assist a human operator in controlling the system. The impact prediction information was used to drive a display which the operator used in controlling the flight of the weapon. It was desired to find whether impact prediction proved useful in weapons control. Author (TAB)

N70-36620# National Aviation Facilities Experimental Center, Atlantic City, N.J. Systems Research and Development Service.
BEACON NUMERICS ON RBDE-5 DISPLAY Final Report
Joseph J. Scavullo Dec. 1969 153 p
(AD-702069; NA-69-44; FAA-RD-69-54) Avail: CFSTI CSCL 17/7

The Air Traffic Control Radar Beacon System (ATCRBS) was modified so as to expand the decoding capability at the indicator site of Air Traffic Control Radar Beacon Interrogator (ATCBI-3) to 4096 discrete identity codes. An Altitude Code Processor was developed to process transponder replies to Mode C interrogations. Radar Bright Display Equipment (RBDE-5) was augmented with Numerics Display Generators. The resulting Beacon Numerics Display System was implemented at Air Route Traffic Control Centers (ARTCC) at Atlanta, Georgia, and at Indianapolis, Indiana, as a tool for use in evaluating the operational utility of beacon numerics on the RBDE-5 displays. Author (TAB)

N70-36651# National Aviation Facilities Experimental Center, Atlantic City, N.J. Systems Research and Development Service.
INERTIAL NAVIGATION SUPPORT, PHASE 3 Final Report
Robert H. Mayer Mar. 1970 72 p refs
(AD-702090; NA-70-24; FAA-RD-70-3) Avail: CFSTI CSCL 17/7

The report considers several aspects of the use of inertial navigation and guidance in the U. S. Domestic Air Traffic environment. It presents flight test data taken on regular scheduled commercial cargo jet aircraft flights of the Sperry SGN-10 Inertial Navigation system (INS.) It further presents an operational study of inertial guidance as compared with the present VORTAC system of navigation. The results of the data analysis and the study indicate that it is feasible to use inertial navigation during the enroute portion of the flight and that benefits can thereby be obtained. It also shows that very little use of the system could be realized in the terminal areas under the present standard instrument departures (SIDs) and approach procedures. A cost-benefit study showed that the cost of operation and ownership exceeded the benefits derived unless the cost of operation was prorated with some other service, such as international guidance. Author (TAB)

N70-36687*# Boeing Co., Seattle, Wash.
A SURVEY OF PRECISION-POINTING SYSTEMS
Douglas C. Fosth *In* NASA, Washington Opt. Telescope Technol. 1970 p 73–81 (See N70-36676 20-14)
Avail: CFSTI HC $10.00/MF $0.65 CSCL 17G

Precision pointing of orbiting astronomical telescope requires a control system to hold the vehicle in the desired attitude for the experiment period, the maneuver schemes, target acquisition, and offset pointing requirements. The current state-of-the-art of pointing and stabilization systems is satisfactory for many applications. Torque sources are being developed and current pacing items are considered for the guidance areas. Tighter pointing accuracies require the development of new equipment and techniques with emphasis on offset pointing. G.G.

N70-36728*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CONTROL SYSTEMS FOR LARGE SPACECRAFT REQUIRING PRECISE STABILIZATION
Willard W. Anderson *In its* Opt. Telescope Technol. 1970 p 425–435 refs (See N70-36676 20-14)
Avail: CFSTI HC $10.00/MF $0.65 CSCL 17G

Research efforts directed toward the development of integrated vehicle stabilization and experiment pointing systems for large spacecraft are discussed. The research areas include vehicle stabilization, vehicle dynamics, experiment pointing, and disturbances. The development of the Apollo Telescope Mount cluster and a

space station for the mid-1970's is described. The space station simulation system used as an aid in development of the vehicles and pointing systems research is also described. R.B.

N70-36729*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
STABILIZATION AND CONTROL OF THE APOLLO TELESCOPE MOUNT
W. B. Chubb *In its* Opt. Telescope Technol. 1970 p 437–448 refs (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 17G

A pointing and control subsystem for Apollo Telescope Mount experiments subjected to external and internal disturbances such as gravity gradient, aerodynamic, and onboard astronaut motion is described. The subsystem includes one unit to provide pointing and control of the cluster and another to provide fine pointing and control of the experiment spar. The control moment gyro (CMG) is used as the momentum-exchange device for cluster control. A control system using flex-pivot gimbal bearings for control about two axes and an open-loop, roll, crank-around devide for positioning about the third axis is used for the fine pointing and control requirements of the spar. Dynamic control about the third axis is supplied by the CMG control subsystem. Author

N70-36730*# General Electric Co., Philadelphia, Pa.
STABILIZATION AND CONTROL FOR THE OAO SPACECRAFT SERIES
K. W. Jenkins *In* NASA, Washington Opt. Telescope (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 17G

The primary position reference, consisting of a system of gimballed star trackers, for stabilization and control of the OAO spacecraft is described. Balance booms are used to make the vehicle inertially spherical to minimize the disturbance torques during pointing. The system used to counteract the buildup of reaction wheel speed due to solar pressure is also described. R.B.

N70-36731*# Kollsman Instrument Corp., Syosset, N.Y.
STAR-TRACKER SYSTEMS
Ludwik I. Seifert *In* NASA, Washington Opt. Telescope Technol. 1970 p 457–463 refs (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 17G

In determining sources for celestial references used by orbiting astronomical observatories, a number of experimental targets was selected at random, and, using their celestial coordinates, brighter suitable guide stars were picked, one for each target. Some targets offered more than one guide star, which provided a tradeoff between magnitude and offset angle in some instances. The study shows that at least two guide stars for each target are necessary to compensate for errors due to roll instability and that a smaller offset angle is desirable. Author

N70-36732*# Perkin-Elmer Corp., Norwalk, Conn.
PRECISION POINTING OF LARGE APERTURE, DIFFRACTION-LIMITED, SPACE TELESCOPES
Herbert F. Wischnia *In* NASA, Washington Opt. Telescope Technol. 1970 465–471 refs (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 17G

A two-meter diffraction-limited telescope pointing system was analyzed as a control source for the Large Telescope Experiment Program. The basic data of minimum pointing error is shown as a function of telescope diameter, servo bandwidth, and star brightness. The plotted curves show that the two-meter telescope, utilizing a 1 Hz servo-equivalent noise bandwidth and having 33% optical and 6% quantum efficiencies, can theoretically achieve a 0.0005 arc-second rms performance when tracking twelfth magnitude stars. Additional pointing errors caused by background light, phototube dark current, and noise from electronic control circuitry can be reduced by specific design measures and by a servo bandwidth reduction. Author

N70-36733*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CONTROL TECHNOLOGY FOR LARGE ORBITING TELESCOPES
Gordon F. Bullock, Frederick R. Morrell, and Aaron J. Ostroff *In its* Opt. Telescope Technol. 1970 p 473–484 refs (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 17G

The stabilization and fine pointing of a 120-inch-diameter orbiting telescope are discussed. An attitude-stabilized telescope passively coupled to a crew module is analyzed. The principle of operation and the experimental results of a fine-pointing sensor applicable to large orbiting telescopes are explained. A technique for star-image motion compensation by the use of optics internal to the telescope is described and an error scaling technique that allows the attitude control system to be simulated is discussed. Author

N70-36772*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PERFORMANCE OF TWIN GYRO ATTITUDE CONTROL SYSTEM INCLUDING PASSIVE COMPENSATION AND NONLINEAR CONTROL LAW
Richard A. Campbell Washington Aug. 1970 107 p refs (NASA-TN-D-5868; M-209) Avail: CFSTI CSCL 17G

The first objective of this paper is to determine the effects on the performance of a twin control moment gyro (CMG) attitude control system, when the CMG is attached to the vehicle structure by a passive compensation network, consisting of a paralleled spring and viscous damper. The second objective is to derive and evaluate a nonlinear control law that enables a twin CMG control system to perform large angle maneuvers at rates equivalent to those of a reaction control jet system and yet maintain the attitude acquisition accuracy of a CMG system. These objectives are first investigated using analytical methods. The results are then verified by experimental simulation of the control systems. The results of the investigation concerning the insertion of the passive compensation network indicate that its principal advantage is to decrease the magnitude of the gyro's developed control torques, thus increasing the bearings lives of the gimbal shafts. The nonlinear control law accomplished all its objectives. It appears most applicable for space vehicle missions requiring many fast, accurate, large angle maneuvers. Author

N70-36843# Airborne Instruments Lab., Deer Park, N.Y.
STUDY OF GLIDE-SCOPE MONITOR FAILURE DUE TO WEATHER Final Report
C. Creedon Jun. 1969 173 p refs
(Contract FA-67-WA-1750)
(FAA-RD-69-48) Avail: Issuing Activity

Monitors for glide slope equipment subject to false alarms when precipitation covers the ground in the radiation field of the glide slope antennas are discussed. Emphasis is placed on preventing false alarms from the on-path course position monitor and from the off-path clearance/width monitor. Analysis points to the monitor-area reflecting zone of ground cover as the cause for false alarms. Recommendations point to the development of glide slope antennas with built-in RF probe loops to sample the antenna signals and transmission line combinations. Detection of such combinations of pickup-loop samples serves to monitor the signals, assuming that the structure of the antenna assemblies remained undisturbed; additional monitor devices are recommended for

measuring the stability of the physical structures. The three principal phases of this study are: compilation of background data relating to the project, theoretical analysis of monitor techniques, and special measurements. Author

N70-36848# National Aviation Facilities Experimental Center, Atlantic City, N.J.

LIVE TESTS OF TOWER CAB RADAR APPROACH CONTROL PROCEDURES Final Report, Apr. 1969 – Apr. 1970

J. Roy Bradley, Jr. and Hugh D. Milligan Aug. 1970 20 p Supported by FAA

(FAA-NA-70-38; FAA-RD-70-31) Avail: CFSTI

This project was conducted primarily to determine the operational feasibility of using bright radar indicator - tower equipment (BRITE-1) as a display to provide all standard radar services from low density control tower cabs and secondarily to delineate BRITE-1 installation and maintenance requirements involved with the tower cab radar approach control operation. Two BRITE-1 displays were installed to the control tower at Wilkes-Barre, Pa. along with appropriate radio and interphone equipment. The approach control operation was then moved from the terminal radar control (TRACON) room to the tower cab where all radar services were provided, on a test basis, for a 60-day period. Results indicate that it is feasible, and desirable, to provide all standard radar services from the tower cab, at low density radar facilities, using the BRITE-1 display. BRITE-1 installation and maintenance requirements involved with the tower cab radar approach control concept were determined and documented. Author

N70-36849# National Aviation Facilities Experimental Center, Atlantic City, N.J.

NAVAID FLIGHT CHECK CONSOLE Final Report

John E. Jensen Aug. 1970 31 p

(FAA-NA-70-57; E70-2) Avail: CFSTI

A portable receiving, conditioning, and recording system to evaluate the performance of common system enroute and terminal aids to navigation is described. The receiving equipment and signal conditioning are conventional, as is the presentation of displayed and recorded information. Features to facilitate recorder trace identification and to normalize and ease the operating specialist's workload were included. Flight tests were conducted with the system installed in DC-6B aircraft N-114. The recorded data compared favorably with equivalent data obtained in the same flight period using T-29 aircraft N-247, configured as a standard flight inspection aircraft. All of these flight tests were conducted in accordance with the applicable portions of the United States Standard Flight Inspection Manual. The Flight Check Console consists of a single channel self-contained airborne navigation system capable of receiving signals from VOR, TACAN, LOCALIZER, GLIDE SLOPE and MARKER BEACON stations in the various assigned frequency bands. It also provides self-contained VHF Communications and such signal conditioning, recording, control, and display features as to allow the analysis of transmitted signals for the purpose of determining performance. Author

N70-36886*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Guidance and Control Div.

GUIDANCE AND CONTROL ANALYSIS AND INTEGRATION

In its Space Programs Sum. No. 37-62, Vol. 3 30 Apr. 1970 p 149 – 157 refs (See N70-36876 20-34)

Copyright. Avail: CFSTI CSCL 17G

A test van, data acquisition equipment, prime power, test support, and systems engineering were provided for the completion of the strapdown electrostatic gyro aerospace navigator. Plasma immersion probe tubes were employed for evaluating electron emission capabilities of various metals in contact with alkali metal vapor. A similar tube was effectively used to study oxygen effects that coadsorb with cesium vapor on the electron emission of tantalum electrodes. Results are also presented for cadmium sulfide work function tests at nonzero current densities. J.A.M.

N70-36887*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Guidance and Control Div.

SPACECRAFT CONTROL

In its Space Programs Sum. No. 37-62, Vol. 3 30 Apr. 1970 p 158 – 175 refs (See N70-36876 20-34)

Copyright. Avail: CFSTI CSCL 17G

A valve evaluation program for use in nitrogen attitude control gas systems for Mariner spacecraft was initiated. The science package point error due to structural vibration of the supporting beams in the thermoelectric outer planet spacecraft was analyzed. Two dimensional, molecular, gas leakage flow rates were measured. A modified mechanization of the solar electric propulsion, spacecraft translator, feedback compensation is described, along with a minimum redundancy transformation between body and inertial frame for a typical strapdown inertial navigation. State determination for disturbed limit cycle operations via nonlinear filtering is also discussed. J.A.M.

N70-36912# Ohio Univ., Athens. Dept. of Electrical Engineering.

INSTRUMENT LANDING SYSTEM IMPROVEMENT PROGRAM Interim Report, Jan. 1969 – Jan. 1970

R. W. Redlich, R. H. Mc Farland, and J. T. Gorman Jan. 1970 124 p refs

(Contract FA-69-WA-2066)

(EER-5-10; FAA-RD-70-9; SRDS-RD-70-9) Avail: CFSTI

Two analog-type monitors were designed, built and tested to provide a reliable and accurate representation of the ILS localizer signal as seen by an aircraft flying on an approach. One monitor involves detector pickups at the radiating antenna elements and the other uses seven directional elements located 300 feet in front of the localizer array. Both monitors are designed to give quantitative representations of conditions in the far-field which are generated by a wide aperture source. Mathematical models are described which are used for predicting effects on localizer path due to large reflecting surfaces such as hangars and large aircraft. From these models information can be derived for the most critical placement of the reflecting surfaces. Calculations and discussions of the anomalous behavior of the glide paths at San Francisco, and Oakland, California are discussed. Author

N70-36914# National Aviation Facilities Experimental Center, Atlantic City, N.J.

NAS EN ROUTE STAGE A, MODEL 1b, TEST AND EVALUATION OF THE PREPRODUCTION EQUIPMENT AN/FYQ-47 Final Report, Feb. 1969 – Apr. 1970

Karl H. Burkard Sep. 1970 54 p refs Supported by FAA

(FAA-NA-70-35; FAA-NS-70-2) Avail: CFSTI

A test program was conducted on the AN/FYQ-47 production common digitizer (PCD) to verify its operational capability as an element of the National Airspace System en route stage A, model 1b, Jacksonville, and the U.S. Air Force semiautomatic ground environment system. Based on the test results, it was concluded that the PCD performed its basic function of digitizing primary and secondary radar video inputs. Adjustments and circuit modifications to improve the PCD performance relative to search target split-rates, and radar quantizer operation in the clutter mode are suggested. The source of beacon range (hit-sharing) splits was not determined. Author

N70-36935# National Aviation Facilities Experimental Center, Atlantic City, N.J.

EVALUATION OF TACAN CW INTERFERENCE

MODIFICATION Final Report, Mar. 1968 – Aug. 1970
G. J. Hartranft and H. Postel Sep. 1970 43 p ref Supported by FAA
(FAA-NA-70-30; FAA-RD-70-53) Avail: CFSTI

The results of laboratory and field tests of a developed modification designed to alleviate the CW interference problems that were suspected of causing outages of GRN-9 and RTB-2 TACAN (transponder) ground systems is presented. Previous investigation concluded that the level of spurious RF CW, radiated by certain airborne interrogators tested, was of sufficient magnitude to cause transfer or shutdown of TACAN equipment used for air navigation when located near taxiways and/or runways of airports. The modification was field-evaluated at four commissioned facility sites and was found successful in preventing equipment transfers or shutdowns of TACAN at ground facilities caused by CW interference. Author

N70-36938* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ATTITUDE CONTROL FOR SPACECRAFT Patent
Frank F. Batsch, John Laub, and Francis R. Mitchell, inventors (to NASA) Issued 20 Apr. 1965 (filed 20 Apr. 1961) 5 p Cl. 60-35.5 Sponsored by NASA
(NASA-Case-XNP-00294; US-Patent-3,178,883; US-Patent-Appl-SN-182696) Avail: US Patent Office CSCL 17G

A space vehicle attitude control system is described which includes a compact jetting device to expel small puffs of air or other gas on command from the vehicle or from a remote station. The attitude control devices are oriented in yaw, roll, and spin axes of movement. The devices may be adapted in environments which require a device responsive to a low energy signal that will trigger a cocked mechanism allowing a predetermined volume of pressurized gas or liquid to be discharged causing the flow to cease The energy in the pressurized gas or liquid is used to re-cock the device for repeated operation. E.C.

N70-36943* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ATTITUDE ORIENTATION OF SPIN-STABILIZED SPACE VEHICLES Patent
Howell D. Garner and Henry J. E. Reid, Jr., inventors (to NASA) Issued 27 Apr. 1965 (filed 25 Jan. 1961) 10 p Cl. 244-1
(NASA-Case-XLA-00281; US-Patent-3,180,587; US-Patent-Appl-SN-84962) Avail: US Patent Office CSCL 17G

A spin stabilized final stage space vehicle is described which has horizon scanning means associated with reaction control devices arranged for positive flight attitude maintenance. The method of vehicle attitude orientation includes continuously rotating the vehicle about an axis, constraining a vehicle mounted scanning device to rotate a line offset from the axis, sighting through the scanning device, and controlling the vehicle attitude in the desired relationship with the local horizon in response to attitude errors detected through the sighting. P.A.B.

N70-36950# National Aviation Facilities Experimental Center, Atlantic City, N.J.
EXECUTIVE SUMMARY OF TECHNICAL AND OPERATIONAL EVALUATION OF THE DIRECT ALTITUDE AND IDENTITY READOUT (DAIR) SYSTEM INTERROGATOR SET AN/TPX-42) Final Report, Sep. 1968 – Jul. 1969
Anthony D. Bradley and Robert L. Tarr Aug. 1970 16 p refs
(FAA-RD-70-29; FAA-NA-70-43) Avail: CFSTI

A summary of both the technical and operational evaluation of the AN/TPX-42 Direct Altitude and Identity Readout (DAIR) equipment is given. It includes a brief description of the system and a statement of the purpose and specific objectives of the effort. Following a statement of the testing and data collection methods employed during the evaluation, the major conclusions are listed concerning the technical suitability, operational capability, controller utility, maintainability, and reliability of the DAIR System. Author

N70-37033# National Aviation Facilities Experimental Center, Atlantic City, N.J.
A COMPARATIVE ANALYSIS OF INDIVIDUAL AND SYSTEM PERFORMANCE INDICES FOR THE AIR TRAFFIC CONTROL SYSTEM Final Report
Edward P. Buckley, William F. O'Connor, Tom Beebe, William Adams, Gordon MacDonald et al Sep. 1969 343 p refs
(NA-69-40; RD-69-50) Avail: Issuing Activity

A simulation study was conducted to examine the relationships of several field facility air traffic controller performance indices with simulation-developed system performance measures. Thirty six air traffic controllers, ranging in age from 31 to 45, from four Air Route Traffic Control Centers served as test subjects. The study encompassed performance criteria developed within two distinct environments; namely, the controller's home facility where he controlled live traffic, and a specifically designed micro-system or one-man ATC system in a dynamic simulation environment at NAFEC. Thus, the experiment represented a comparative examination of several quantitative measures of system functioning derived from air traffic control simulation and, simultaneously, an investigation of these measures as indices for the objective evaluation of the individual air traffic controller. The study presents estimates of the relationship between various performance and evaluation indices. Data from the micro-system model suggested a new system performance criterion which was found sensitive to system load differences. Author

N70-37557*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ATTITUDE CONTROL OF A SPACECRAFT WITH A STRAPDOWN INERTIAL REFERENCE SYSTEM AND ONBOARD COMPUTER
John Hrastar Washington Sep. 1970 23 p refs
(NASA-TN-D-5959) Avail: CFSTI CSCL 17G

A study was conducted with an advanced Orbiting Astronomical Observatory (OAO) using a three-axis control law previously proven globally stable. The control system can reorient the spacecraft to an arbitrary inertial attitude with a single command by operating the three momentum wheels simultaneously. Reorientation, therefore, becomes a simple extension of a hold or pointing mode. The time required for reorientation with this system is considerably shorter than the time required for a series of single-axis slews. The spacecraft attitude and control law are continuously updated by the onboard digital computer's using information provided by the strapdown inertial reference system. The use of a computer and inertial reference system with characteristics of systems presently under development demonstrates the feasibility of orientation with such a reference system. The basic system is not limited to the OAO but may be adapted for other three-axis-stabilized spacecraft. Author

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N70-36222# Army Engineer Nuclear Cratering Group, Livermore, Calif.
THE NCG FALLOUT SCALING MODEL: A GRAPHIC-NUMERICAL METHOD OF PREDICTING FALLOUT PATTERNS FOR NUCLEAR CRATERING DETONATIONS Final Technical Report
Donald E. Burton Jan. 1970 94 p refs
(AD-704688; NCG-TR-19) Avail: CFSTI CSCL 18/8

A scaling model is developed to predict the H + 1 hour exposure rate in the area contaminated by the radioactive fallout from an underground nuclear detonation fired at any depth of burst. Exposure rate predictions can be made within the base surge region in both the upwind and crosswind directions and in the downwind fallout pattern to a distance at which the 0.01 R/hr exposure contour would be experienced. These predictions can then be used to construct isoexposure-rate contour maps for feasibility studies. The model is developed by requiring the observed and predicted exposure rates for seven underground (DANNY BOY, TEAPOT ESS, CABRIOLET, SEDAN, SCHOONER, JANGLE U, and BUGGY) and two surface (JANGLES and JOHNIE BOY) detonations to be consistent. The results indicate that predictions based on this model will be reliable to within a factor of 2 to 4. A significant result of this investigation was a method of the partitioning of activity between the base surge and the main cloud. Author (TAB)

N70-38235# United Nuclear Corp., Elmsford, N.Y. Research and Engineering Center.

FAST REACTOR MIXED-CARBIDE FUEL ELEMENT DEVELOPMENT PROGRAM Quarterly Progress Report, Jul.–Sep. 1969

1 Dec. 1969 44 p refs

(Contract AT(30-1)-3415)

(UNC-5251; QPR-9) Avail: CFSTI

Three fuel rods containing helium-bonded, high-density mixed-carbide pellets were discharged from the EBR-2 with a peak burnup of 57,000 Mwd/t. The experiment designed to measure the fission gas released by various mixed-carbide fuel compositions at temperatures up to 1600 C achieved its goal burnup of 20,000 Mwd/t and was discharged from the DUN irradiation testing facility. Three of the four experiments containing sodium-bonded, mixed-carbide pellet fuel rods were discharged from the GETR after achieving their goal burnup of 50,000 Mwd/t. Thirty-two hundred and seventy-five UO2-25 wt % PuO2 pellets for the Westinghouse irradiation program were prepared to specification and shipped. Author (NSA)

N70-38274# Naval Weapons Lab., Dahlgren, Va.

OPTIMUM INTERPOLATION INTERVAL AND ORDER IN SATELLITE EPHEMERIDES

Jane V. Robinson Apr. 1970 22 p refs

(AD-705501; NWL-TR-2372) Avail: CFSTI CSCL 22/3

This study was undertaken to provide source data from which optimum interpolation intervals and orders could be selected for use in geodetic solutions. In order to maintain a maximum interpolation error of approximately 0.1 meter in the coordinates, an optimum interpolation interval of 240 seconds at 10th or 12th order was selected for the 500 nautical mile altitude satellite, an interval of 120 seconds at 8th order for the 100 n.m. altitude satellite, and an interval of 1440 seconds at 8th order for the 11,000 n.m. altitude satellite. A reduction of interpolation accuracy occurs when the interpolation interval is increased or the order of interpolation decreased. Due to the contribution of non-Keplerian gravity field terms to interpolation errors, the errors are attributed to orbit perturbations rather than to the central gravitational term. Results from comparisons of velocity errors obtained from differentiated interpolated coordinates with those obtained from interpolated velocities show greater accuracy in the differentiated velocities. Timing studies provide a basis for minimizing computer time usage when a large number of interpolations are performed for a large set of functions and derivatives. Author (TAB)

N70-38283# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.

VANADIUM ALLOY CLADDING DEVELOPMENT Quarterly Report, Period Ending 31 Dec. 1969

Feb. 1970 24 p refs

(Contract AT(30-1)-3791)

(WARD-3791-45) Avail: CFSTI

Small double arc melted ingots were prepared for use in research on interstitial effects in vanadium. Detailed plans for this program, using an ultrahigh vacuum system in conjunction with a microbalance, were made. A kinetic analysis was made of the reactions between vanadium and oxygen and nitrogen. Lower interstitial absorption was observed in vanadium alloys exposed to sodium at 690 C than previously reported for samples exposed at higher temperatures. In the vanadium alloy-fuel compatibility study, no reactions were observed in fuel samples examined. However, some incompatibility was seen in the vanadium alloy samples in contact with stoichiometric UC and hyperstoichiometric (U,Pu)C. The samples in contact with chromium stabilized (U,Pu)C fuel exhibited in an attempt to substantiate these findings. The vanadium alloy samples inserted in EBR-2, in the WARD/BNW High Flux Program have reached approximately half their goal exposure. Author (NSA)

N70-38680*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CRITICALITY STUDY OF MELTDOWN CONFIGURATIONS FOR NUCLEAR AIRCRAFT REACTORS

Conrad J. Lennon and Robert E. Hyland Washington Aug. 1970 20 p refs

(NASA-TM-X-2068; E-4973) Avail: CFSTI CSCL 18K

As part of a containment system study for the nuclear aircraft reactors, a description of the meltdown problem is presented along with curves of reactivity for reflected and unreflected slabs, spheres, and cylinders as a function of UO2 fuel loading, composition and size. These are presented to help the early design concepts avoid configurations that would cause excursions in the event of a core meltdown and thereby obtain a feasible containment system. Results are presented which indicate that masses that have melted down from reactors can be kept subcritical provided certain geometrical dimensions for specific dilutions of fuel are not exceeded within the containment system. Author

N70-38670# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.

INVESTIGATION ON REACTIVITY VALUES OF Pu-U ROD CLUSTERS BY AN OSCILLATION METHOD

A. Boeuf, E. Macke, and S. Tassan Jun. 1970 175 p refs

(EUR-4486.e) Avail: CFSTI

The reactivity worths of synthetic Pu-U clustered fuel elements, in a D2O moderated assembly, were experimentally determined using the reactor oscillation method. Five different test-fuel compositions were investigated, representing varying degrees of fuel burn-up and burn-up distributions; two uranium samples with different U-235 enrichment were used as standard. The technique selected was aimed to establish clean experimental conditions, so as to effectively simplify the analysis of the results. Basically, it consisted in oscillating, according to a square-wave pattern, a 6 m long fuel element containing a 50 cm high test section with the investigated fuel composition: the corresponding neutron density modulation was interpreted in terms of a Fourier analysis. The results of the experiment for a consistent set of data, which can be used as test values for refined reactor burn-up calculation codes. The overall experimental error, typically + or – 0.015 pcm, is considered low, in view of the massive and complex experimental set-up used. Evidence is given to the peculiar aspect of the measurement, i.e.: oscillation of heavy load, complex geometry fuel elements in a D2O moderated reactor, for high precision reactivity determinations. Author

N70-38787# Japan Atomic Energy Research Inst., Tokai.

A STUDY OF DESTRUCTIVE ENERGY RELEASED AT FAST BREEDER REACTOR MAXIMUM HYPOTHETICAL

ACCIDENT
Michio Ishikawa, Naohiro Hirakawa, and Kanji Tasaka Jul. 1970 24 p refs
(JAERI-1188) Avail: CFSTI

A computing model to calculate destructive energy release at maximum hypotehtical accident, is developed. Two types of energy release, pressure wave propagation and vapor blast pressure, are considered as realistic destructive energy release, since they are demonstrated in numbers of past reactor destructive tests, and they exist in rapid explosion, such as TNT powder explosion and chemical gas explosion. In the computing model, acoustic impedance effect resulting from the molten core expansion is assumed for the pressure wave propagation, and results of past reactor destructive tests are refered to in the vapor blast pressure calculation. The calculations were carried out on the hypothetical accident of JEFR (Japan Experimental Fast Reactor), and it is found that 8 MW-S of energy would be released by pressure wave propagation with 960 kg/sq cm of peak pressure and that 98 MW-S of energy would be released by vapor blast pressure with 21 kg/sq cm of equilibrium pressure. These results make good correspondence with the 1/5 scaled mock up vessel explosive test performed with 400 g TNT powder in JAERI, 1968. This model seems to give more realistic estimation of destructive energy released at the maximum hypothetical accident of a fast breeder reactor than those models generally used. Author

N70-36780# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
MONTE CARLO SHIELDING CALCULATIONS
B. Mc Gregor Mar. 1970 12 p refs
(AAEC/TM-531) Avail: CFSTI

The problems studied concern neutron transmission through ordinary concrete shields and ducts. For this problem, the Monte Carlo method provides an accurate and practical method of calculation. The study highlighted the stringent data requirements for shielding calculations. In particular, it showed that detail is required in the valleys of the total neutron cross section. Author

N70-36786# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
COLLISION PROBABILITY CALCULATIONS IN CLUSTER GEOMETRY
G. Doherty Mar. 1970 30 p refs
(AAEC/E-205) Avail: CFSTI

Four methods for the calculation of multigroup collision probabilities in cluster geometry are described. These are Monte Carlo, full numerical integration, numerical integration over the annuli containing rods combined with the Bonalumi approximation in the moderator annuli, and a ring smearing method again based on the Bonalumi approximation for annular geometry. Results of six group calculations for three tight, natural uranium, D2O lattices are presented in detail. The results suggest that the ring smearing model is suitable for cluster calculations which do not require high accuracy. The largest error is in the thermal flux in the outer moderator regions. This error is a general problem inherent in the Bonalumi approximation and is not peculiar to the ring smearing model presented. Author

N70-36822# Atomic Energy Commission, Washington, D.C. Office of Safeguards and Materials Management.
REACTOR FUEL BURNUP CALCULATIONS: AN ANNOTATED BIBLIOGRAPHY OF SELECTED LITERATURE
Guy M. Inman, comp. 15 Oct. 1969 32 p refs
(WASH-1142) Avail: CFSTI

A total of 155 references to unclassified reports and published literature on nuclear fuel burnup is included. The material was taken from that appearing in Nuclear Science Abstracts from January 1, 1965 to July 30, 1969. The references are arranged by issuing agency with the latest work appearing first. Personal author and report number indexes are provided. The report number index indicates, for each report, the source through which the publication is made publicly available. Author (NSA)

N70-36939# European Atomic Energy Community, Karlsruhe (West Germany).
INSPECTION OF IRRADIATED MATERIALS BY MEANS OF A MICROPROBE AS ILLUSTRATED BY U-O2-MO AND UO2-ZIRCALOY NUCLEAR FUEL CERMETS
G. Giacchetti and J. Ransch Jun. 1970 60 p refs In GERMAN; ENGLISH summary
(EUR-4504.d) Avail: CFSTI

Knowledge of the chemicophysical behavior of the fuel elements and reactor components in the core is of crucial importance with regard to the functioning and useful life of a reactor. Although in principle all methods which were used, even for non-irradiated samples, such as physical inspection, gas analysis X-ray spectrometry, alpha and beta autoradiography and metallographic inspection, may be applied, microanalysis by the electron beam microprobe appears to be particularly suitable as a means of obtaining information on the distribution of fission products in the fuel elements, diffusion processes or corrosion phenomena in cladding materials. Author

N70-36978# Bettis Atomic Power Lab., Pittsburgh, Pa.
THE POROSITY CORRECTION FACTOR FOR THE THERMAL CONDUCTIVITY OF POROUS MATERIALS (LWBR DEVELOPMENT PROGRAM)
G. P. Marino Feb. 1970 45 p refs
(Contract AT-(11-1)-GEN-14)
(WAPD-TM-807) Avail: CFSTI

The variation of the porosity correction factor, beta, with temperature and pore shape was studied by using the Fricke equation for the thermal conductivity of a two-phase medium containing the second phase as randomly distributed ellipsoids. The conductivity of the pores was also calculated for various gas contents in the pores. The thermal radiation contribution to pore conduction was also included. The effect of pore shape was determined via the axial ratio, epsilon, of oblate or prolate ellipsoidal pores. The results are presented graphically in curves showing the variation of beta with the parameters gamma and epsilon. The above model was applied to actual conductivity data of ThO2 and ThO2 – UO2 specimens in an effort to correlate the general porous structure typical of ceramic fuels to the parameters epsilon and gamma in the Fricke equation. It was shown that the beta factor for ceramic fuels could be related to their general microstructure and pore conductivity in a self-consistent mathematical framework. Author (NSA)

N70-37006# Babcock and Wilcox Co., Lynchburg, Va. Research and Development Div.
GEL-ADDITION PROCESS CHEMICAL STUDIES Quarterly Progress Report, Nov. 1969 - Jan. 1970
R. V. Carlson, comp. Apr. 1970 26 p refs
(Contract AT(30-1)-3714)
(BAW-3714-16; QPR-14) Avail: CFSTI

THe development of a sol-gel process and related processes for preparing (U,Pu)O2 fast reactor fuels was continued. About 6 kg of U-235O2 sol and 550 g of PuO2 sol were prepared by precipitation-peptization techniques. The unit-operation-scale spheroidizing system was operated without the organic regeneration system. About 250 g of coarse and 150 g of fine U(235)O2 - 20% PuO2 microspheres were prepared. The U(235)O2 - 20% PuO2 pellets and shards required for the initial EBR-2 irradiation test were nearly completed. Because of a design change in the EBR-2 pins, additional UO2 blanket and insulator pellets were prepared. Four capsules in a series designed to show the differences in restructuring kinetics of pellets and vibratory compacted spheres and shards were irradiated in the BAWTR. The exposure time varied from 3 to 81 days at 6 to 20 kW/ft. Author (NSA)

N70-37053# Bettis Atomic Power Lab., Pittsburgh, Pa.
FIGRO (ADDENDUM 2): A CDC-6600 COMPUTER PROGRAM FOR THE ANALYSIS OF FUEL SWELLING AND CALCULATION OF TEMPERATURE IN BULK-OXIDE CYLINDRICAL FUEL ELEMENTS (LWBR DEVELOPMENT PROGRAM)
L Goldberg and L. L. Lynn Apr. 1970 22 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-618-ADD-2) Avail: CFSTI

The FIGRO computer program calculates temperatures and fuel swelling in bulk-oxide cylindrical fuel elements. The addition of a heat conduction model for the analysis of rapid transients such as those encountered in hazards and safeguards studies is described. Other additions account for the effect on gap conductance of the release of volatile gases from the fuel, reduction of gap thickness due to clad creep, ternary fission helium release, and the existence of clad corrosion layers. FIGRO now requires 100,000 octal locations to run on the CDC-6600 SCOPE 3.1 operating system. A sample problem is presented. Author (NSA)

N70-37054# Los Alamos Scientific Lab., N.Mex.
LOADING OF SODIUM-BONDED FUEL CAPSULES
D. N. Dunning 24 Feb. 1970 16 p refs
(Contract W-7405-eng-36)
(LA-4393) Avail: CFSTI

Equipment and procedures are described for assembling experimental, sodium-bonded LMFBR fuel pins and other capsules associated with the Los Alamos Scientific Laboratory (LASL) mixed carbide fuel program. Details of the system used for supplying sodium of known and controllable quality are given along with sodium analytical equipment and procedures. Also included are procedures for the handling and inspection of (U,Pu)C fuel and the bonding of fuel pellets to stainless steel cladding. Analyses of supply sodium and glovebox gas are shown. Author (NSA)

N70-37055# Los Alamos Scientific Lab., N.Mex.
PHENIX: A TWO DIMENSIONAL DIFFUSION BURNUP REFUELING CODE
R. Douglas O'Dell and Thomas J. Hirons Jun. 1969 121 p refs
(Contract W-7405-eng-36)
(LA-4231) Avail: CFSTI

PHENIX is a two dimensional, multigroup, diffusion-burnup-refueling code for use with fast reactors. The code is designed primarily for fuel cycle analysis of fast reactors and can be used to calculate the detailed burnup and refueling history of fast breeder reactor concepts having any generalized fractional batch reloading scheme. Either ordinary calculations or searches on material concentrations or on region dimensions can be performed at any time during the burnup history, using the standard source iteration technique. The refueling option of the code accounts for the spatial flux shifts over the reactor lifetime in the calculation of fuel discharge. All programming is in FORTRAN 4, and the storage requirements are designed so that the code fits in a 64k memory of a CDC-6600 computer. Author (NSA)

N70-37058# California Univ., Berkeley. Lawrence Radiation Lab.
THE BERKELEY SYNCHROCYCLOTRON IMPROVEMENT PROGRAM
L. Kanstein, R. Sorensen, L. Glasgow, J. Vale, and K. Mac Kenzie Sep. 1969 22 p refs Presented at Intern. Cyclotron Conf., Oxford, Engl.
(Contract W-7405-eng-48)
(UCRL-19447; CONF-690921-4) Avail: CFSTI

Studies to improve the 184 inch Berkeley synchrocyclotron have led to a design for a new RF system providing higher dee voltage and repetition rate. The one-half scale model is described along with a brief description of a model high power broadband beam stretching cee. Author (NSA)

N70-37078# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
USE OF TRACERS IN DEVICES FOR LOCALIZING LEAKS IN FUEL ELEMENT CANS [EMPLOI DES MARQUEURS DANS LES DISPOSITIFS DE LOCALISATION DE FUITES DE GAINE D'ELEMENT COMBUSTIBLE]
Rene Donguy Apr. 1970 33 p refs in FRENCH; ENGLISH summary
(CEA-BIB-177) Avail: CFSTI

This chronological literature survey covers the period from January 1961 to June 1969. At the latter date the most frequently used gaseous tracers were the xenon isotopes and the solid tracer was Au-198 used in conjunction with Sb-122. Author (ESRO)

N70-37097# Oak Ridge National Lab., Tenn.
PRELIMINARY APPRAISAL OF THE HAZARDS PROBLEMS OF A D-T FUSION REACTOR POWER PLANT
A. P. Fraas and H. Postma May 1970 32 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2822) Avail: CFSTI

A preliminary assessment of the hazards problems of a D–T fusion reactor was made to provide some notion of the seriousness of these problems in possible future applications of thermonuclear power plants. The inherent characteristics of magnetically confined plasmas appear to be such that any tendency toward general power overshoots or local hot spots will be more than compensated by other factors, so that there should be no difficulties with either general or local temperature or power excursions that might cause a meltdown or an explosion. In turning to radiological hazards, the principal source of concern is tritium. Fortunately, fusion reactor systems will ordinarily be designed so that the bulk of the tritium produced will be consumed as fuel. Thus, though the tritium production rate will run roughly 1000 times that in a fission reactor, by proper plant design the tritium inventory can be kept to about the same level as in a conventional fission reactor such as a PWR. Author (NSA)

N70-37116# Oakridge National Lab., Tenn. Metals and Ceramics Div.
FUELS AND MATERIALS DEVELOPMENT PROGRAM Quarterly Progress Report, Period Ending 31 Mar. 1969
P. Patriarca, comp. and D. J. Rucker, ed. Aug. 1969 58 p refs
(Contract W-7405-eng-26)
(ORNL-4420) Avail: CFSTI

The research and developments for this period are reported. Topics include: development of fast reactor oxides, and LMFBR fuels, cladding, and tubing; mechanical properties of cladding; and metallurgy of tungsten and refractory alloys. F.O.S.

N70-37118# Gulf General Atomic, San Diego, Calif.
HYDROLYSIS OF URANIUM AND THORIUM CARBIDES
R. D. Burnette 1 Oct. 1969 36 p refs
(Contract AT(04-3)-167)
(GAMD-9670-Rev) Avail: CFSTI

The work included (1) basic reaction rate studies, (2) measurements of changes in gross physical parameters such as volume and density, (3) the effects of these changes on restraining graphite structures such as fuel element sleeves, and (4) fission-product release from irradiated fuel materials. The rate studies indicated that the reaction of water vapor with uncoated ThC2 or UC2 is rapid at all temperatures from ambient to 750 C. There is some indication of a minimum reaction rate around 400 C. The upper limit for the hydrolysis reaction is 500 to 600 C, above which pure oxidation occurs (i.e., conversion to ThO2 or UO2). Volume changes of up to 85% were observed for uncoated (Th,U)C2 particles following hydrolysis at room temperature, with less expansion at higher temperatures. The release of noble gases from fuel materials undergoing hydrolysis was observed to be increased; however, escape of other fission products, such as iodine, was relatively insignificant. Author (NSA)

N70-37136# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
FAILURE IN PIPES AND PRESSURE VESSELS CORRELATED WITH NUCLEAR POWER PLANT SERVICE [RUPTURE EN SERVICE DE TUBES ET CAISSONS DE REACTEURS NUCLEAIRES]
Marie-Genevieve Le Levier Mar. 1970 93 p refs In FRENCH; ENGLISH summary
(CEA-BIB-79-Add-1) Avail: CFSTI

This bibliographical review deals with 243 references selected from volumes 20, 21 and 22 of Nuclear Science Abstracts for the period July 1966–December 1968. Author (ESRO)

N70-37146# Commissariat a l'Energie Atomique, Saclay (France).
RECOVERY OF TRANSPLUTONIUM ELEMENTS [RECUPERATION DES ELEMENTS TRANSPULTONIENS]
Jean-Yves Espie, Benjamin Poncet, and Alain Simon Mar. 1970 133 p refs In FRENCH; ENGLISH summary Prepared jointly with Inst. Natl. des Sci. et Tech. Nucl.
(CEA-R-3744) Avail: CFSTI

The recovery of americium and curium from fission-product solutions obtained from processing irradiated fuel elements made of natural metallic uranium alloyed with aluminium, iron and silicon was studied; these elements had been subjected to an average irradiation of 4000 MWdays/ton in a gas-graphite type reactor having a thermal power of 3.7 MW/ton of uranium. The process consisted of (a) an extraction cycle in 40 per cent tributylphosphate (TBP), extraction of actinides and lanthanides and elimination of fission products (b) an extraction cycle in 8 per cent 2-diethyl-hexylphosphoric acid, decontamination from fission products and decontamination of actinides from lanthanides (c) an extraction cycle in 40 per cent TBP and separation of the complexing agent and concentration of the actinides (d) an americium-curium separation by precipitation. Author (ESRO)

N70-37150# Mound Lab., Miamisburg, Ohio.
MOUND LABORATORY CHEMISTRY AND PHYSICS PROGRESS REPORT, OCTOBER–DECEMBER 1969
11 May 1970 23 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1612) Avail: CFSTI

Topics covered include: preparation of LiH and LiD single crystals, residue adsorption, U-234 recovery, Po-210 recovery, boron recovery, comparison of gamma scan and calorimetry data on cans of Pu-238 residues, determination of U concentration by isotope dilution method, isotopic analysis of enriched boron samples, plutonium isotopic sample exchange data evaluation, improving scan speed and attenuation reliability of a mass spectrometer, and temperature-integrator data collection system. NSA

N70-37174# Commissariat a l'Energie Atomique, Cadarache (France). Centre d'Etudes Nucleaires.
CONTRIBUTION TO THE STUDY OF THE STABILITY OF WATER-COOLED REACTORS [CONTRIBUTION A L'ETUDE DE LA STABILITE DES REACTEURS REFROIDIS PAR DE L'EAU]
Claude Coudert (Ph.D. Thesis—Aix-Marseille Univ., 25 Jun. 1969) Oct. 1969 191 p refs In FRENCH; ENGLISH summary
(CEA-R-3890) Avail: CFSTI

This report deals with the stability of reactors cooled by water subjected only to natural convection. It describes theoretical and experimental work devoted to both linear and nonlinear conditions. Calculation of the transfer function of the reactor using neutronic and hydrodynamic linear equations and the determination of the instability threshold are treated, and the existence of the limiting oscillation cycle in the case of a linear feedback using Malkin's method is demonstrated. The measurement and interpretation of the reactor transfer functions and the hydrodynamic transfer functions, as well as the analysis of the noise due to boiling, are also considered. Author (ESRO)

N70-37180# Atomic Energy Establishment, Winfrith (England).
A MEASUREMENT IN GLEEP OF THE THERMAL NEUTRON ABSORPTION CROSS SECTION OF A SAMPLE OF HIGHLY PURIFIED SILICON
R. J. Maddison and P. M. V. Jones Mar. 1969 5 p refs
(AEEW-M-887) Avail: AEC Depository Libraries; HMSO: 1s 6d; BIS $0.30

A measurement was made in GLEEP of the thermal neutron absorption cross section of a highly purified sample of natural silicon. This has given a value of 0.176 + or − 0.005 barns compared with the previous value of 0.160 + or − 0.020 barns. Author (NSA)

N70-37190# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
USE OF BORON AS BURNABLE POISON IN EL 4 MODERATOR DURING START-UP TESTS [UTILISATION DU BORE COMME POISON SOLUBLE DANS LE MODERATEUR DU REACTEUR EL 4 PENDANT LES ESSAIS DE DEMARRAGE]
Jean Cherot and Yves Girard Jan. 1970 58 p refs In FRENCH; ENGLISH summary
(CEA-R-3932) Avail: CFSTI

Boron, in the form of boric acid in the moderator of a heavy-water reactor, is useful for measuring reactivity balances and was used in EL 4 start-up tests to compensate the excess reactivity of the first load and as a reactivity reference at power for measuring the xenon effects and following the fuel evolution. The techniques and results are described along with the difficulties in determining the involved concentrations. Several poisons for compensating the excess reactivity were compared e.g. lithium, cadmium, gadolinium, and boron. Author (ESRO)

N70-37192# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Experimentelle Kernphysik.
IS THE ELECTRON RING ACCELERATOR (ERA) USEFUL FOR THE ACCELERATION OF HEAVY IONS?
H. Schopper Oct. 1969 8 p refs
(NP-18231) Avail: AEC Depository Libraries

The physical parameters and capabilities of the electron-ring accelerator for heavy ion acceleration are briefly discussed. The energy–intensity relation, energy spread, and length of the accelerator are considered. NSA

N70-37205# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorbauelemente.
FUEL RODS WITH INNER RIBS. A POSSIBILITY FOR LOWERING THE FISSIONABLE MATERIALS REQUIREMENTS IN FAST BREEDER REACTORS [BRENNSTAEBE MIT INNENRIPPEN EINE MOEGLICHKEIT ZUR SENKUNG DES SPALTSTOFFBEDARFS BEI SCHNELLEN BRUTREAKTOREN]
S. Malang and K. Rust Dec. 1969 36 p refs In GERMAN
(KFK-1118) Avail: AEC Depository Libraries

For two types of fuel elements the temperature distribution within the rods was calculated under various conditions. One type of rod possessed inner ribs of Incoloy running lengthwise. The second type has a cam plate arrangement in horizontal position. At the same central temperature, efficiency of rods with inner ribs was 25% and that with cam plates was 50% higher than that of conventional fuel rods. Variations of height, volume, and number of ribs as well as fuel element diameter, fuel density, and heat transfer between fuel and cladding showed that the highest achievable power output is determined predominantly by the height of the ribs. Moreover, the highest achievable efficiency, conversely to conventional fuel rods, increased with diameter. Therefore, new considerations for optimal rod diameter were necessary. NSA

N70-37208# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorentwicklung.
COOLANT BOILING IN SODIUM-COOLED FAST REACTORS
E. G. Schlechtendahl Jun. 1969 145 p refs Transl. into ENGLISH from German report KFK-1020 Sponsored by US-Euratom
(EURFNR-701; KFK-1020) Avail: CFSTI

The Na boiling in the narrow geometry of a fuel element of a Na-cooled fast reactor is studied. The study is limited to the cases in which the coolant channel geometry is not perturbed by tubular cladding widening or deposition of extraneous substances. The typical differences of liquid metal boiling phenomena from those of water are theoretically interpreted. Boiling is described analytically. Results of calculations with the BLOW 2 core are compared with test results. Very good agreement is found for the growth of the first bubble. In the further course of vaporization and condensation, deviations occur which are clearly due to the assumption of thermodynamic steady-state in the longitudinal direction of the bubble. While boiling delay is the crucial parameter for the growth of the first bubble, the behavior of the residual liquid film on the heating surface is of great importance for the subsequent oscillating movements of the bubble. For selected in-pile coolant perturbations, vapor bubble dynamics are studied and interpreted with regard to their importance for reactor safety.
Author (NSA)

N70-37222# Michigan State Univ., East Lansing.
NUCLEAR CHEMISTRY RESEARCH Annual Report, 1969
William C. McHarris 1969 212 p refs
(Contract AT(11-1)-1779)
(COO-1779-13) Avail: CFSTI

The experimental facilities utilized are discussed, including the cyclotron and backup equipment, and the development of a rabbit-pneumatic target is described. Analysis and plotting methods in gamma spectroscopy are discussed. Experimental results reported include data on beta and electron capture decay of bismuth-205, ground state and isomeric iron-53, ytterbium-167, zinc-62, and zinc-63. Gamma energies and intensities for bismuth-205 are presented, along with gamma spectra from ytterbium-167, zinc-62, zinc-63, and samarium-141, and beta and gamma spectra from iron-53. Energy levels are reported for manganese-53 from iron-53 decay, promethium-141 from samarium-141 decay, and lead-205 from bismuth-205 decay.
P.A.B.

N70-37255# Gulf General Atomic, San Diego, Calif.
OBJECTIVES AND PLANS FOR FUEL TESTING IN THE PEACH BOTTOM HTGR
K. P. Steward 23 Apr. 1970 40 p Presented at ORNL Gas-cooled Reactor Program Inform. Meeting, Oak Ridge, Tenn., 27-29 Apr. 1970
(Contracts AT(04-3)-633; AT(04-3)-167)
(GA-10065; Conf-700401-3) Avail: CFSTI

The Peach Bottom reactor offers unique capabilities as a test facility for HTGR fuels. It can irradiate HTGR fuel in a proper neutron spectrum, in a pressurized helium environment, and in an HTGR temperature regime. The Peach Bottom reactor can accommodate kilogram quanties of test fuels for long periods, and complete fuel elements assemblies can be tested to evaluate the interactions of fuel particles, fuel beds, and geaphite structures. One of the fundamental objectives of Peach Bottom Core 2 is to exploit the unique capabilities of this reactor as a test facility for irradiation of HTGR fuel concepts. Four types of test elements for insertion with Core 2 are described. The major objectives of each element type are as follows: to evaluate the performance of HTGR fuels over a wide range of operating conditions; to provide irradiated HTGR fuel in sufficient quantities to develop recycle processing technology, and to test recycle particles; to provide large scale tests of 1100-MW(e) HTGR fuel; and to demonstrate irradiation performance of Fort St. Vrain fuel. Author (NSA)

N70-37256# Los Alamos Scientific Lab., N.Mex.
LMFBR/FFTF FUEL DEVELOPMENT ANALYTICAL CHEMISTRY PROGRAM, PHASE 2
James R. Rein, R. Keith Zeigler, and Charles F. Metz 16 Mar. 1970 29 p refs
(Contract W-7405-eng-36)
(LA-4407) Avail: CFSTI

An evaluation of the adequacy of methods of analysis is presented for 13 chemical specifications of LMF BR-FF TF mixed uranium–plutonium oxide fuel. This evaluation is based on statistical analyses of the results obtained by seven laboratories on a distributed batch of FF TF fuel pellets and distributed special blends of certain impurities and a high purity uranium–plutonium oxide matrix. Recommended areas of improvement are given.
Author (NSA)

N70-37260# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.
EXPERIMENT ON THE BEAM EXTRACTION BY AN ELECTROSTATIC DEFLECTOR FROM THE JINR 2-METRE ISOCHRONOUS CYCLOTRON
I. A. Shelaev, V. S. Alfeev, S. I. Kozlov, V. M. Nikolaev, and R. Ts. Oganesyan 1970 12 p refs In RUSSIAN
(JINR-P9-5037) Avail: AEC Depository Libraries

Extraction of the ion beam from the JINR 2-meter isochronous cyclotron by a system combining an electrostatic deflector and focusing magnetic channel is described.
Author

N70-37261# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.
ORBIT PARAMETERS OF THE 2 METER JINR ISOCHRONOUS CYCLOTRON
I. A. Shelaev, S. I. Kozlov, and B. A. Kleinin 1970 18 p refs In RUSSIAN
(JINR-P9-5033) Avail: AEC Depository Libraries

The scheme of the calculation of the orbit parameters and phase graphs, adopted by processing the data of the magnetic field measurements of the 2-metre isochronous cylotron, is described. The results of this calculation performed by use of the BESM-4 computer are presented. It is shown that the values of the betatron oscillation frequences, obtained according to the approximate analytical formulae, agree well with the results of numerical integration.
Author (NSA)

N70-37269# General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation.
SOUTHWEST EXPERIMENTAL FAST OXIDE REACTOR DEVELOPMENT PROGRAM Quarterly Report, Nov. 1969–Jan. 1970
G. R. Pflasterer and R. A. Becker, comps. Feb. 1970 36 p refs
(Contract AT(04-3)-540)
(GEAP-10010-23; QR-23) Avail: CFSTI

Startup tests are described. Reflector worths are presented. Flow and pressure coefficients of reactivity are measured. Operations and maintenance requirements during November 1969 to January 1970 are listed.
NSA

N70-37274# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
DYNAMIC SIMULATION OF PRIMARY LOOP CHECK VALVES FOR THE FAST FLUX TEST FACILITY
J. E. Krajicek May 1970 15 p refs
(Contract AT(45-1)-1830)
(BNWL-1347) Avail: CFSTI

A dynamic simulation digital program for FFTF primary loop check valves of the tilting disk or swing check types has been

developed. The model considers all moments acting on the valve disk. Included are the inertial, pivot-pin friction, valve disk weight, torsional spring, fluid, and damping moments. The developed check valve logic can be added to a previously developed digital program for dynamic simulation of the entire reactor and primary loops. The dynamic response of the system using the combined programs is shown for typical accidents. Author (NSA)

N70-37276# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Experimentelle Kernphysik.
MEETING ON CONVERSION OF A MISSING MAGNET MACHINE TO A PARTLY SUPERCONDUCTING SYCHROTRON
F. Arendt, J. Erb, W. Schauer, and W. Wuertz, comps. Nov. 1969 22 p refs Conf. Held at Karlsruhe, W. Ger., 29 Oct. 1969
(NP-18223) Avail: AEC Depository Libraries

Discussions at the meeting held at Karlsruhe to consider problems in the conversion of a high-energy, missing-magnet proton-synchrotron to a partly superconducting one are presented. In this conversion, magnet-free spaces of the synchroton lattice are filled with superconducting dipoles. Topics include considerations on the lattice with respect to conversion and extraction, attainable field accuracy and reproducibility, stored energy, magnetic shielding and eddy currents, vacuum and refrigeration system and radiation damage. Also, a review of actual and future activities in different laboratories is given. Author (NSA)

N70-37282# Oak Ridge National Lab., Tenn.
ANOMALOUS RESISTIVITY IN TOKAMAK TM-3
A. Hirose, M. Murakami, and I. Alexeff May 1970 5 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2988) Avail: CFSTI

The anomalously low electrical conductivity observed in the Tokamak TM-3 device is interpreted in terms of an ion-acoustic instability. Author (NSA)

N70-37284# United Kingdom Atomic Energy Authority, Risley (England). Reactor Group.
HIGH-TEMPERATURE REACTOR
N. H. Mc Laren Apr. 1970 15 p refs
(TRG-Rept-1996) Avail: AEC Depository Libraries

In the U. K. the helium cooled high temperature reactor is known as the Mark III GCR, Mark I and II being the Magnox and AGR designs, respectively. The development of the reactor engineering and of the fuel is described. A description of a typical Mark III reactor design is given. NSA

N70-37291# European Organization for Nuclear Research, Geneva (Switzerland).
APPARATUS FOR MEASUREMENT OF THE FREQUENCY OF BETATRON OSCILLATIONS OF THE 70-GeV ACCELERATOR BEAM [APPAREILLAGE DE MESURE DE LA FREQUENCE DES OSCILLATIONS BETATRONIQUES DU FAISCEAU DE L'ACCELERATEUR DE 70 GeV]
V. A. Uvarov Oct. 1969 9 p Transl. into FRENCH of Akad. Nauk SSSR, Moscow report NTD-6826 In FRENCH Presented at the Natl. Conf. on Accelerators, Moscow
(CERN-Trans-69-22; NTD-6826) Avail: AEC Depository Libraries

A system for the rapid measurement of the frequency of betatron oscillations for the 70-GeV accelerator at IFVE is described. The system is based on the principle of the measurement of the period of excited coherent oscillations in fractions of the revolution period of the particles. The system permits a measurement of the difference in Q with a precision of about 10% for a beam deflection of 2 mm at the intensity of 10 to the 10th power p/p and 0.2 mm at 10 to the 11th power. NSA

N70-37293# Institute of Nuclear Sciences, Lower Hutt (New Zealand).
REPORT ON THE WORK OF THE INSTITUTE OF NUCLEAR SCIENCES Progress Report, Jul. – Dec. 1968
Dec. 1968 44 p refs
(NP-18207; INS-344; AEC-322; PR-5) Avail: AEC Depository Libraries

Research progress is reported on nuclear physics, radiation chemistry, isotope geochemistry, radioactive dating and fallout, isotope applications, and instrumentation. NSA

N70-37297# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.
GAUGE INVARIANCE AND REGULARIZATION
B. V. Medvedev, V. P. Pavlov, and A. D Sukhanov 1970 19 p refs In RUSSIAN; ENGLISH summary Presented at the Conf. on High Energy Phys. and Theory of Elementary Particles, Kiev, Oct. 1969
(ITF-70-15; Conf-691035-7) Avail: AEC Depository Libraries

It is shown that Pauli–Villars regularization, in which one needs to preserve the gauge invariance at all the stages of the perturbative calculations, has unusual properties. The values of the convergent integrals of positive-definite functions as well as of divergent ones vanish under this regularization, and the discontinuities arise in the regular parts of divergent graphs. The physical sense of Pauli–Villars procedure and possibility of vanishing of divergent parts of all the graphs are discussed. Author (NSA)

N70-37298# Universidad Nacional Autonoma de Mexico, Villa Obregon. Facultad de Quimica.
ENRICHMENT OF URANIUM BY THERMAL DIFFUSION
Concepcion Morales Cruz 1969 61 p refs In SPANISH
(NP-18173) Avail: AEC Depository Libraries

A design for the enrichment of uranium by thermal diffusion is proposed. The design indicates the most convenient equipment and the subsequent operational problems for the enrichment of natural uranium (0.7% of U-235) up to 2.1% U-235. The theoretical results indicate that the operation in principle is simple, and the equipment requirements are very simple and can be easily fabricated in any institution or laboratory of limited resources. The installation is easy and does not require much horizontal space, only a space with sufficient height. For the thermal diffusion design, the temperatures, wire, and the tube were 298 K for the primary and 1073 K for the secondary loops. The electrical power necessary is 1.675 kW. The calculated cost was $8.55/g of UO2. Construction of the thermal columns derived from the theory is under way. NSA

N70-37300# European Atomic Energy Community, Brussels (Belgium).
RELIABILITY CONSIDERATIONS FOR MECHANICAL COMPONENTS OF CONTROL ROD DRIVE SYSTEMS OF GAS-COOLED POWER REACTORS OPERATING IN THE EUROPEAN COMMUNITY
J. Ehrentreich and H. Maurer [1969] 48 p refs Presented at the meeting of Specialists on the Reliability of Mech. Components and Systems for Nucl. Reactor Safety, Riso, Denmark, 24-26 Sep. 1969
(Conf-690951-1) Avail: AEC Depository Libraries

Different principles adopted by various suppliers of mechanical parts for control-rod drive systems in gas-cooled power reactors operated in the European Community are described on a comparative basis. The function of the different systems is demonstrated by reliability block diagrams and the reliability analyzed for both normal and scram mode of operation. Author (NSA)

N70-37308# Syracuse Univ., N.Y. Dept. of Physics.
CP-VIOLATION IN THE NEUTRAL K SYSTEM
Suk Koo Yun Jan. 1970 34 p refs Supported in part by AEC
(SU-1206-219; NYO-3399-219) Avail: CFSTI

The theoretical aspects of CP violation are considered. The discussion covers the K sub S and K sub L states, unitarity relations, parameterization and analysis, the electric dipole moment of the neutron eta asymmetry and C noninvariance, and various theoretical models. NSA

N70-37317# California Univ., Livermore. Lawrence Radiation Lab.
STOCHASTIC APPROXIMATION OF LARGEST NONRESPONSE DOSAGE [STOCHASTISCHE APPROXIMATION DER GROESSTEN UNWIRKSAMEN DOSIS]
H. Harders Dec. 1969 10 p refs Transl. into ENGLISH from Metrika (West Ger.), v. 11, no. 2, 1966 p 106–114
(PB-189888T; UCRL-Trans-10438) Avail: CFSTI CSCL 14B

For the well known dosage response model, the paper gives a sequential procedure for finding a reasonable lower bound for a dosage with a small probability of response. The more general problem of finding a dosage with arbitrary given probability of response is solved by the procedure of Robbins and Monro which, however, contains no stopping rule. It is of considerable practical value to have a procedure with a stopping rule for this important special case. Some heuristic points of view to choose an efficient procedure have been noticed. Author (USGRDR)

N70-37344# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Nazionali di Frascati.
HIGH SENSITIVITY DOUBLE ON LINE QUANTAMETER FOR BUBBLE CHAMBER EXPERIMENTS
M. Coli and B. Stella 31 Oct. 1969 12 p refs
(LNF-69/67) Avail: AEC Depository Libraries

An on-line quantameter for low intensity gamma ray beam operation is described which has two measuring channels for internal control; one for counting the gamma quanta of the beam and the other for the integral measurement of the beam intensity. The detector is lead converter followed by a plastic scintillator. The results are digitally displayed on the chamber pictures. Efforts were made to achieve stability of the system against aging and ambient temperature. Author (NSA)

N70-37357# Tokyo Univ. (Japan). Inst. for Nuclear Study.
HORIZONTAL AIR SHOWER AND ANOMALOUS MUON INTERACTION
Kohei Mizutani and Kenju Mori 9 Feb. 1970 5 p refs
(INSJ-114) Avail: AEC Depository Libraries

Recently, the nature of primaries of horizontal air showers was discussed with regard to the massive SU(3) triplet. It is pointed out there exists another possibility for explaining this phenomenon from the perspective of the supposed anomalous muon interaction as well as from consideration of general aspects of cosmic-ray phenomena. NSA

N70-37362# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
PHYSICAL AND ELECTRONIC CHARACTERISTICS OF CRITICALITY ALARM DEVICES. BEHAVIOR DURING ACTUAL CRITICAL POWER-RISES
Claude Renard Mar. 1970 37 p In FRENCH
(CEA-N-1250) Avail: AEC Depository Libraries

Detection and alarm devices for criticality accidents were developed and consist essentially of neutron or gamma radiation detectors connected to a data processing system. The electronic characteristics of the detectors and the main results of the tests carried out using all available sources, make it possible to explain the operation of these detectors and also to deduce their sensitivity thresholds and their range of detection during an actual critical power rise. The introduction of the CRAC system (radiological consequences of criticality accidents) which is a full-scale reproduction of critical accident conditions in the liquid phase, has shown that a particular type of accident can occur which is not detected by the actual data processing systems. Solutions are proposed which are now being studied or are already being constructed. NSA

N70-37366# Ceskoslovenska Akademie Ved, Rez. Ustav Jaderneho Vyzkumu.
EQUIPMENT FOR MECHANIZATION OF ANALYTICAL OPERATIONS
M. Talas, V. Sraier, and J. Cerny Mar. 1970 18 p refs
(UJV-2315-A-Ch) Avail: AEC Depository Libraries

Equipment was developed for remote analytical operations and determinations (potentiometric titrations and photometry) allowing analytical control of the reprocessing of spent nuclear fuel by countercurrent extraction and for the preparation of samples for radiochemical measurements. The equipment, its location, shielding, use, and control are described. Author (NSA)

N70-37367# Kyoto Univ., (Japan). Research Reactor Inst.
MEASUREMENT OF FAST NEUTRON SPECTRUM WITH Li 6 AND He 3 SANDWICH COUNTERS
Itsuro Kimura, Shu A. Hayashi, Katsuhei Kobayashi, Shinji Ishihara, and Toshikazu Shibata [1969] 42 p refs In JAPANESE; ENGLISH summary
(KURRI-TR-67) Avail: AEC Depository Libraries

The characteristics of neutron detection efficiency and energy resolution of Li-6 and He-3 sandwich counters, were calculated theoretically. The counters were manufactured and tested and the experimental results were compared with the theoretical values. Both energy resolution results agreed satisfactorily. Although direct testing of the detection efficiencies of the counters could not be done, it is shown that the relative values of the detection efficiencies are almost independent of either method of calculation or cross section data. After testing pile-up by gamma rays, linearity of output pulse versus neutron energy, evaluation of background and the effect of He gas pressure, the counters were used to measure fast neutron spectra at the beam port of an experimental tube of KUR. The results show that the spectrum is close to the fission neutron spectrum. Author (NSA)

N70-37369# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.
SWELLING DURING HIGH TEMPERATURE NEUTRON IRRADIATION: THE INFLUENCE OF SURFACE ENERGY AND STACKING FAULT ENERGY ON VOID NUCLEATION
J. T. Buswell Feb. 1970 19 p refs
(RD/B/N-1584) Avail: AEC Depository Libraries

An assessment was made of the influence of the relative energies of vacancy dislocation loops and voids on the susceptibility of a material to swelling during high temperature neutron irradiation. There is experimental evidence that in pure metals in which loops are the lower energy defects, higher fluences are required to produce voids. In stainless steel (AISI 304), and most other alloys the comparative resistance to swelling cannot be explained by an initial absence of void nuclei. Voids are the lower energy defects and potential nuclei are present throughout irradiation. Alloying influences void formation in a way other than through its effect on the energies of loops and voids. It is not feasible to influence the relative energies of dislocation loops and voids by changes in alloy composition. The necessary changes in composition are large and require the removal of the solute. Author (NSA)

N70-37379# General Electric Co., Cincinnati, Ohio. Nuclear Systems Programs.
ANALYSIS OF EBR-2 NEUTRON SPECTRA BY MONTE CARLO AND DISCRETE ORDINATE METHODS
W. E. Edwards, W. B. Henderson, and N. R. Baumgardt Dec. 1969 374 p refs
(Contract AT(40-1)-2847)
(GEMP-742) Avail: CFSTI

Two dimensional multigroup fluxes per MW of power in the EBR-2 reactor, computed by Monte Carlo and by discrete ordinate methods, are presented. These fluxes, together with evaluated n,p cross sections for Ni-58, Fe-54 and Ti-46 were used to correlate core-length dosimetry data obtained from these sensors in rows 2 and 7 of the EBR-2 with stainless steel in the inner radial blanket. The effect on flux distribution and effective sensor cross sections of replacing the stainless steel with depleted U was also calculated. Results are presented. Author (NSA)

N70-37383# Lyon Univ. (France). Inst. de Physique Nucleaire.
HYPERFINE INTERACTION STUDY BY ANGULAR CORRELATIONS [INTERACTIONS HYPERFINES ETUDIEES PAR CORRELATIONS ANGULAIRES]
Gilbert Marest(Ph.D. Thesis) Dec. 1969 91 p refs In FRENCH
(LYCEN-6954) Avail: AEC Depository Libraries

Static magnetic and electric hyperfine interactions and time-dependent interactions were studied by measuring perturbed angular correlations through integral and differential methods. A few applications of hyperfine interactions to nuclear and solid state physics were considered. Thus magnetic moments of the first excited states of Os-192, Pt-192, and Pt-196, and the second excited state of Pt-192 were determined. Then measurements of perturbed angular correlations of the 133-142 keV cascade of TA-181 were performed; the effects of resolution time on these measurements were studied, and a quadrupole perturbation in a Hf O2 source was discovered. An effect subsequent to the (n,gamma) reaction in a polycrystalline complex of hafnium was discovered. An effect subsequent to the (n,gamma) reaction in a polycrystalline complex of hafnium acetylacetonate was revealed. By measuring angular correlations in the decay of Tm-169 excited levels, static electric quadrupole and time depending magnetic dipole interactions were studied in a Yb—Ag compound. NSA

N70-37399# Joint Inst. for Nuclear Research, Dubna (USSR).
NEW METHOD OF THE INFORMATION EXTRACTION FROM SPARK CHAMBERS
Yu. A. Karzhavin, A. T. Matyushin, V. T. Matyushin, and M. N. Khachaturyan 1970 12 p refs In RUSSIAN
(JINR-P13-5016) Avail: AEC Depository Libraries

The results of preliminary experiments on investigation of a new method of the information extraction from spark chambers with solid electrodes are presented. The signals excited by a spark in the chamber electrodes are recorded by a piezoelectric element. Possibilities of designing a spherical chamber are discussed. The volume of the electronic equipment on-line with a computer is estimated. Realization of the method and the chamber would allow creation of a highly efficient high-transmission device with the target being situated inside the chamber for charged particle and gamma-quanta recording. Author (NSA)

N70-37405# European Organization for Nuclear Research, Geneva (Switzerland).
RADIO-FREQUENCY CONTROL SYSTEM FOR THE BEAM OF THE 70 GeV PROTON SYNCHROTRON [SYSTEME DE COMMANDE DE LA FREQUENCE RF PAR LE FAISCEAU DU SYCHROTRON A PROTONS DE 70 GeV]
Yu. S. Ivanov et al Nov. 1969 11 p refs Transl. into FRENCH of Akad. Nauk SSSR, Moscow report NTD-6823 In FRENCH
(CERN-Trans-69-24; NTD-6823) Avail: AEC Depository Libraries

The system for the control of the radio frequency by use of the beam is based on the regulation of the frequency of the pilot generator by signals proportional to the radial displacement of the beam with respect to the nominal orbit and proporational to the dephasing of the center of gravity of the beam with respect to the accelerator field. The control system is described and its operational efficiency is discussed. NSA

N70-37410# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
DEVELOPMENT OF AN ULTRAFINE GRAIN SIZE TYPE 316 STAINLESS STEEL CLADDING
G. A. Reimann May 1970 14 p refs Submitted for publication
(Contract W-7405-eng-26)
(PB-191700; ORNL-TM-2937) Avail: CFSTI CSCL 18J

An ultrafine grain size with a dispersed carbide precipitate was obtained in type 316 stainless steel tubing by repetitive cold working and low-temperature anneals. Such ultrafine grain sizes are unobtainable by using conventional techniques because of the inability to work tubing to large magnitudes without introducing flaws. The fine grain size and dispersed carbides may be a structure that is more resistant to irradiation-induced swelling and embrittlement than conventionally produced tubing. The process may be incorporated into commercial tube drawing practice with little difficulty. Author (USGRDR)

N70-37411# Kyoto Univ. (Japan). Research Reactor Inst.
MEASUREMENT OF FAST NEUTRON SPECTRUM WITH THRESHOLD DETECTORS
Itsuro Kimura, Katsuhei Kobayashi, and Toshikazu Shibata 1969 27 p refs In JAPANESE; ENGLISH summary
(KURRI-TR-61) Avail: AEC Depository Libraries

By using seven threshold reactions, the fast neutron spectrum in the core of the Kyoto University Reactor, KUR, was measured. The result shows that the shape of the spectrum is approximately the same as that of fission neutrons. Therefore, the average cross sections of nine threshold reactions (Ti-46(neutron, proton)Sc-46, Ti-47(neutron,proton)Sc-47, Ti-48(neutron, proton)Sc-48, Si-28(neutron, proton)Al-28, Si-29(neutron, proton)Al-29, Si-30(neutron, alpha)Mg-27, Zn-64(neutron, proton)Cu-64, Pb-204(neutron, neutron')Pb-204m, and Pb-204(neutron, 2 neutron)Pb-203) for this quasi-fission spectrum in KUR were measured. A Ge(Li) counter was mainly used for the measurement of gamma rays from induced activities. Author (NSA)

N70-37412# Kyoto Univ. (Japan). Research Reactor Inst.
MEASUREMENTS OF NEUTRON FLUX AND SPECTRUM AT KUR IRRADIATION FACILITIES
Keiji Kanda, Tsutomu Nanjyo, Katsuhei Kobayashi, Yoshihiro Nakagome, Toshihiko Kozuka, et al 1969 25 p refs In JAPANESE; ENGLISH summary
(KURRI-TR-60) Avail: AEC Depository Libraries

The neutron flux and spectrum at the KUR irradiation facilities were measured by foil activation techniques. By using various kinds of foils, neutron fluxes in the thermal, epithermal, and fast energy regions was absolutely measured. The deviations from the reference neutron spectrum in each energy region were also obtained. The spectral parameters and each flux are tabulated. Author (NSA)

N70-37416# Atomics International, Canoga Park, Calif.
REACTIVITY EFFECTS OF GADOLINIUM-155 ON A SNAP REACTOR
B. J. Dray, W. H. Heneveld, W. A. Rhoades, K. L. Rooney, V. A. Swanson et al 15 Apr. 1970 110 p refs
(Contract AT(04-3)-701)
(AI-AEC-12909) Avail: CFSTI

The SNAPTRAN-1 Reactor, a SNAP 10A reactor specially adapted for high-temperature and transient experiments, was used in the operational reactor phase of the Gd-155 experiments program. The GD-155 was mixed with a nickel powder to serve as a substrate, and rolled and formed into sleeves that were slipped over the individual fuel elements in the core. The experimental program consisted of reactivity measurements at room temperature and elevated temperatures followed by a series of power transients producing significant temperature change to determine the prompt temperature coefficient. These measurements were repeated for each of three concentrations of Gd-155 in the core. The reactivity loss with Gd addition was found to be an almost linear relationship with no observed saturation effect. The expected change in temperature coefficient was found. The transient experiments also showed that Gd-155 made the temperature coefficient less negative, and the amount of the effect increased with increasing temperature. Since the highest Gd concentration was not tested in the transient testing program, the results were inferred by extrapolation. In such case the prompt coefficient would become positive at about 1050 F. Author (NSA)

N70-37418# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

FFTF PROTOTYPIC FUEL PELLETS FOR ANALYTICAL CHEMISTRY PROGRAM Fabrication Report

H. T. Blair Apr. 1970 53 p refs
(Contract AT(45-1)-1830)
(BNWL-1214) Avail: CFSTI

Approximately 4000 sintered, 25 wt% PuO2-75 wt% UO2 type fuel pellets were fabricated in the initial test of the FFTF fuel pin fabrication development and demonstration facility. The materials, equipment, techniques, and sampling used in the fabrication are described. Complete characterization of the sintered pellets including dimensions, density, chemical composition, and homogeneity is reported. The sintered pellets have an average density of 91.35% TD and an average oxygen-to-metal ratio of 1.96. The pellets are homogeneous, and no evidence of the existence of more than one phase was detected. The O/M of 200 of the sintered pellets was reduced to 1.96. One hundred of the pellets were centerless ground for use in determining pellet density by geometrical methods. Author (NSA)

N70-37419# Argonne National Lab., Ill. Reactor Engineering Div.

TWO-DIMENSIONAL HYDRODYNAMICS ANALYSIS FOR PRIMARY CONTAINMENT

Yao-Wen Chang, Joseph Gvildys, and Stanley H. Fistedis Nov. 1969 92 p refs
(Contract W-31-109-eng-38)
(ANL-7498) Avail: CFSTI

A numerical method is described for calculating the two-dimensional hydrodynamic response of a primary reactor containment system to a high-energy excursion. Equations of hydrodynamics and equations of state of reactor materials are expressed in Lagrangian form and then set into finite difference equations. Shock discontinuities are eliminated by the use of the von Neumann – Richtmyer pseudoviscosity. These equations, along with pressure pulse and other pertinent input data, are programmed for solution on the IBM-360 computer. Propagation of shock waves, loads imposed on different parts of the reactor components, and the resulting damage are determined at every time step until the steel vessel ruptures or the force acting on the rotating shield plug exceeds the strength of the plug holddown device. Calculated displacements and pressures at all spatial points at any instant of time also are given in pictorial form. Author (NSA)

N70-37420# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

VOID FRACTION PROFILE IN A NUCLEAR REACTOR VESSEL DURING COOLANT BLOWDOWN

N. P. Wilburn Apr. 1970 147 p refs
(Contract AT(45-1)-1830)
(BNWL-1295) Avail: CFSTI

An experimental and analytical study of the phenomena that occur in the reactor vessel and piping during a postulated accidental loss of coolant from a light water cooled nuclear power reactor is discussed. The study of liquid vapor in a vessel and the consideration of the two-phase flow which occurs in the outlet pipe or orifice are analyzed. The liquid vapor action during blowdown (with top, middle and bottom nozzles) from a vessel without internal structures is studied. Author (NSA)

N70-37421# Oak Ridge National Lab., Tenn.

HIGH FLUX ISOTOPE REACTOR Quarterly Report, Jan. – Mar. 1970

R. V. Mc Cord and B. L. Corbett 14 May 1970 20 p
(Contract W-7405-eng-26)
(ORNL-TM-3000) Avail: CFSTI

Operations and maintenance requirements during January to March 1970 are presented. Modifications for reactor components are described. NSA

N70-37422# General Electric Co., Sunnyvale, Breeder Reactor Development Operation.

RESULTS OF SEFOR ZERO POWER EXPERIMENTS

L. D. Noble, F. Mitzel (Kernforschungszentrum), B. Sarma, D. Wintzer, (Kernforschungszentrum) and Y. S. Lu et al Mar. 1970 244 p refs Prepared for Southwest At. Energy Associates
(Contract AT(04-3)-540)
(GEAP-13588) Avail: CFSTI

The results of the low (zero) power tests are presented and are compared with calculations. The agreement between experiment and calculation is generally good. The tests were conducted at low power and included such experiments as the approach to the minimum critical core size, calibration of the reflector control, measurement of fission rate distributions, material reactivity worth measurements, uniform non-nuclear heating of the reactor to determine the reactivity temperature coefficient, and the measurement of the ratio of the prompt neutron lifetime to the effective delayed neutron fraction. Author (NSA)

N70-37429# Lyon Univ. (France). Inst. de Physique Nucleaire.

NUCLEON ELASTIC SCATTERING WITH NON-LOCAL SEPARABLE POTENTIALS

J. Pigeon, J. Barguil, C. Fayard, G.-H. Lamot, and E. El Baz 5 Mar. 1970 9 p refs
(LYCEN-7015) Avail: AEC Depository Libraries

The neutron or proton elastic scattering on He-4 below 22 MeV was studied using a one-term nonlocal separable potential. The theoretical phase shifts obtained are in very good agreement with the experimental data. The nuclear potential chosen identical for the neutron and proton, gives nearly idential parameters. Author (NSA)

N70-37437# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.

WHIST: A PROGRAM FOR PROCESSING WIMS OUTPUT

P. W. Johnson Jan. 1970 21 p refs
(RD/B/N-1579) Avail: AEC Depository Libraries

Much of the manual processing of the output from WIMS which was developed for multigroup lattice calculations, and also of the WIMSD version is eliminated by use of the facility WHIST. WHIST reads WIMSD history tape, carries out a lifetime calculation, including the estimation of rating histories, and also produces lattice data in CRAM and FLEET forms together with graphite damage rates. NSA

N70-37443# Oak Ridge National Lab., Tenn.
ORNL NUCLEAR SAFETY RESEARCH AND DEVELOPMENT PROGRAM Bimonthly Report, Jan. – Feb. 1970
Wm. B. Cottrell May 1970 161 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2919) Avail: CFSTI

Work in general support of water-cooled power reactor technology is discussed, including LOFT and industry programs, and reflects current safety problems such as measurements of prompt fuel element failure phenomena and the efficacy of containment-spray and pool-suppression systems for fission-product removal. Also included are studies on the release and behavior of accident-released fission products, as well as the removal of these fission products and aerosols from gas streams by filters and absorbers. Several projects were also conducted in support of the High-Temperature Gas-Cooled Reactor and Liquid-Metal Fast Breeder Reactor programs. Other projects include studies of primary piping and steel pressure-vessel technology. Experimental work relative to pressure-vessel technology includes investigations of the attachment of nozzles to shells and the implementation of programs on heavy-section steel technology and nuclear piping, pumps, and valves. Development of engineering safeguards and the establishment of codes and standards for government owned or sponsored reactor facilities are discussed. Author

N70-37447# Australian Atomic Energy Commission, Coogee.
THEORETICAL ANALYSIS OF FUEL ROD VIBRATION INDUCED BY PARALLEL COOLANT FLOW
Ken Namatame Mar. 1970 13 p refs Transl. into ENGLISH from Nippon Genshiryoku Gakkaishi (Tokyo), v. 11, No. 7, 1969 p 398–405 In ENGLISH and JAPANESE
(LIB/Trans-246) Avail: AEC Depository Libraries

A theoretical analysis was made of fuel rod vibration in nuclear reactor coolant channel with water flowing parallel to the rod axis. The analysis was based on the fact that the force inducing the fuel rod vibration is the pressure fluctuation of water flowing in the channel, and that this pressure fluctuation travels along the channel with a speed proportional to the mean water velocity. Using the result of the present analysis, a comparison was made with previous experimental results. It was found that the present analysis could very well explain the observed behavior of rod vibration, and that it could further serve in deducing other characteristics so far remaining unclarified. Author

N70-37451# Institutt for Atomenergi, Kjeller (Norway).
BURNAPAN: A FORTRAN CODE FOR DEPLETION OF BURNABLE POISONS INSIDE A CYLINDRICAL PIN WITH ANISOTROPIC NEUTRON INCIDENCE
M. Gamal Zaalouk Nov. 1969 54 p refs
(KR-138) Avail: AEC Depository Libraries

The basic physics analysis and programming of the Burnable Poison Depletion Code BURNAPAN are presented. This is a one dimensional code which calculates the space and depletion dependent flux inside a cylindrical pin containing a highly absorbing (thermal) material (Gladolinium). The calculation assumes polyenergetic, anisotropic neutron flux incident on the surface of the pin. From the obtained flux distribution the self-shielding factor, effective macroscopic absorption cross section, and poison content are calculated as functions of neutron flux time. Associated with the program is a library program LIBRAGAD which calculates the energy dependent microscopic absorption crosss sections of the Gadolium isotopes Gd-155 and Gd-157 and provides a table of energy integral functions to be used with the BURNAPAN code. For comparison purposes, the depletion calculation using the neutron transport code K-7 JAN-THERMOS is also presented. Author (NSA)

N70-37455# Kyoto Univ. (Japan). Research Reactor Inst.
LOW TEMPERATURE IRRADIATION FACILITY OF THE KYOTO UNIVERSITY REACTOR (KUR): ITS CONSTRUCTION AND PERFORMANCE
Toshikazu Shibata, Shiro Iwata, Hiroyuki Yoshida, Masuo Nakagawa, Moritami Okada et al 21 Oct. 1969 56 p refs In JAPANESE
(KURRI-TR-69) Avail: AEC Depository Libraries

In order to study the effects of radiation damage, it is necessary to maintain the specimens at low temperatures during irradiation and measurements. Accordingly, a low temperature irradiation facility capable of sustained operation down to 10 K was constructed. The facility consisted of two major parts; one is an irradiation cryostat of which the head was located in a horizontal exposure hole of the reactor, and the other was a helium gas refrigeration system. An automatic temperature control system by an adjustment of the flow rate of the circulating helium gas was included in this facility. Flux distributions of gamma radiation, thermal, and fast neutrons at the head of the irradiation cryostat was measured. Safety analysis of the facility is discussed. Some experimental results on the physical properties such as electrical resistivity and internal friction of some metals and alloys both during and after irradiation at low temperature are also reported. Author (NSA)

N70-37464# Michigan Univ., Ann Arbor. Cavitation and Multiphase Flow Lab.
TIME DEPENDENT NUCLEATE BOILING REQUIREMENTS FOR LIQUID SODIUM
R. E. Nystrom (Naval Ship Res. and Develop. Lab., Panama City, Fla.) and F. G. Hammitt Apr. 1970 4 p refs Submitted for publication
(Grant NSF GK-1889)
(PB-191250; UMICH-01357-8-i) Avail: CFSTI CSCL 18I

The objective of this investigation is to obtain time dependent superheat requirements for liquid sodium under conditions which may be encountered in a sodium cooled fast breeder nuclear reactor. Superheat is defined as the amount that the temperature of the liquid must be increased above the saturation temperature to cause nucleate boiling. By determining the onset of cavitation in liquid sodium which actually measures the effective vapor bubble radius in the sodium, and then converting these data to superheat requirements using thermodynamic properties of sodium, the objective was attained. Cavitation was produced in the liquid sodium by utilizing a high temperature ultrasonic vibratory cavitation facility. Author (USGRDR)

N70-37538# Oak Ridge National Lab., Tenn. Office of Language Services.
DEVELOPMENT WORK ON REPROCESSING OF THORIUM NUCLEAR FUELS, 1 JULY–31 DECEMBER 1969 [ENTWICKLUNGSARBEITEN ZUR AUFARBEITUNG THORIUMHALTIGER KERNBRENNSTOFFE]
K. H. Engel and U. Tillessen 31 Dec. 1969 11 p refs Transl. into ENGLISH from German report WA-101/68-6
(ORNL-tr-2303; NUKEM-6) Avail: CFSTI

The development of a head-end combustion process is described. In the second half of 1969 the hot-cell, experiments begun in Juelich with a small laboratory furnace were continued. In Wolfgang the combustion was tested on an industrial scale with air enriched in oxygen. On the basis of the present state of knowledge, improved industrial design for a plant of 10 kg fissionable material per day was developed. Fundamentally different results are obtained for carbide and oxide elements in regard to the release of liquid and gaseous fission products. The retaining power of the mixed oxide crystals for Kr-85 amounted to about 98%, while in the case of the lattice transformation of the carbide to the finely divided oxide, carbide fuel, only 60 ppM of the heavy metal that decomposes into dust, including the incorporated fission product, were discharged through the metal filter candles of the furnace into the deep bed filter. Author (NSA)

N70-37539# Westinghouse Electric Corp., Pittsburgh, Pa. Advanced Reactors Div.
LMFBR FUEL ROD DESIGN LIMITS AND TRANSIENT SURVIVAL CRITERIA
Mario D. Carelli, Carl A. Anderson, Jr., and Robert A. Markley [1970] 4 p
(Contract AT(30-1)-4135)
(TID-25419) Avail: CFSTI

Design limits such as maximum allowable cladding and fuel temperatures and tolerable amount of molten fuel are calculated for LMFBR fuel rods. The performance of the fuel elements under normal and off-normal transient conditions is analyzed. NSA

N70-37540# Gulf General Atomic, San Diego, Calif.
HTGR FUEL IRRADIATION PERFORMANCE AND IMPLICATIONS ON FUEL DESIGN
W. V. Goeddel, E. O. Winkler, and C. S. Luby 23 Apr. 1970 21 p refs Presented at Gas-Cooled Reactor Program Inform. Meeting, Oak Ridge, Tenn., 27-29 Apr. 1970
(Contracts AT(04-3)-633; AT(04-3)-167)
(GA-10012; Conf-700401-2) Avail: CFSTI

The fuel element design for large HTGRs is a hexagonal graphite block containing coated particles in bonded fuel rods. The excellent irradiation performance of the multilayered BISO and TRISO coated particles has been demonstrated in 250 successful tests to burnups up to 59% FIMA, fast fluences up to 8.7 × 10 to the 21st power n/sq cm, and temperatures up to 1450 C. Beds of coated particles bonded into fuel rods with carbonaceous matrices have been demonstrated to be stable during 18% FIMA burnup and 6 × 10 to the 21st power n/sq cm fast fluence at 1250 C. Irradiation testing of the reference graphite has shown it to have adequate dimensional and structural stability over the full range of HTGR operating conditions. Author (NSA)

N70-37555# Rensselaer Polytechnic Inst., Troy, N.Y.
LINEAR ACCELERATOR PROJECT Annual Technical Report, 1 Oct. 1968 – 30 Sep. 1969
30 Sep. 1969 177 p refs
(Contract AT(30-1)-328)
(RPI-328-171) Avail: CFSTI

Neutron elastic scattering from iron at 1 to 500 keV and neutron capture of copper 65 were measured. Reentrant hole perturbation effects on fast neutron spectra in aluminum assembly are considered. Using various level density parameters, scandium 45 photon reactions analysis at 25 to 76 MeV was studied, along with occupation ratios for tantalum 182 energy levels during neutron capture. Resonance parameters of promethium 147 were also investigated. J.A.M.

N70-37578# Kyoto Univ. (Japan). Research Reactor Inst.
IRRADIATION STUDIES AT DRY ICE TEMPERATURE IN PNEUMATIC TUBE AND SLANT TUBE OF KUR
1969 15 p refs In JAPANESE
(KURRI-TR-65) Avail: AEC Depository Libraries

The mechanical properties of polyethylene capsules utilized in the irradiation facilities of KUR (Pneumatic Tube and Slant Tube) were studied, and the capsules were irradiated at dry ice temperature. Irradiation-induced radioactivity radioisotopes, and changes of mechanical strength of the capsules irradiated at 1 Mw were detected experimentally. Weight changes of dry ice in the capsule and the temperature change in the capsule filled with dry ice were measured under the same conditions. From the results of the experiments, it is concluded that the irradiation of the samples in the polyethylene capsule at dry ice temperature can be performed safely without any damage to the reactor and the irradiation facilities. Author (NSA)

N70-37582# European Atomic Energy Community, Ispra (Italy).
RELIABILITY CONSIDERATIONS FOR ELECTRO-MECHANICAL AND HYDRAULIC CONTROL ROD DRIVE SYSTEMS
J. Ehrentreich and H. Maurer 1968 57 p refs Presented at Meeting on the Reliability of Elec. Supply Systems and Related Electro-Mech. Components for Nucl. Reactor Safety, Ispra, Italy, 27-28 Jun. 1968
Avail: AEC Depository Libraries

In the design of control rod drives different principles are adopted by the various suppliers. The systems used with water-cooled power reactors are described comparatively and analyzed with respect to their reliability for normal and scram operation. The following points are considered: (1) Drawing up of system block diagrams as the basis for the reliability analysis for normal and scram operation. (2) Estimation of possible fault rates of system components on the basis of test and operational results. (3) Comparison of the analytically determined inherent system reliability with the operational system reliability of various control rod drives. (4) Reliability analysis of the complete control systems (total number of control and safety rods) on the basis of the analysis of the individual rod drives and critical comparison of the various design principles. Author (NSA)

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N70-36203# Arizona Univ., Tucson. Optical Sciences Center.
OPTICAL SCIENCES CENTER NEWSLETTER. VOLUME 4, NO. 1: DEDICATION ISSUE
Jan. 1970 77 p refs
(AD-700318) Avail: CFSTI CSCL 20/6

Contents: The relationship of the Optical Sciences Center to mission-oriented agencies; Industrial relations; The academic program; The research program (lens design, pattern recognition, digital image processing, analog image processing, mathematical optics, thin film optics, earth resources photography, infrared research, quantum optics, physiological optics and visual perception, holography, electro-optical devices, glass and glass-crystalline optical materials, and predicting mirror deflections); Publications; Optical shop; and Building floor plans. TAB

N70-36221# Hughes Aircraft Co., Culver City, Calif. Electronic Properties Information Center.
REFRACTIVE INDEX OF OPTICAL MATERIALS IN THE INFRARED REGION DATA SHEETS
A. J. Moses Jan. 1970 255 p refs
(Contract F33615-68-C-1225)
(AD-704555; EPIC-DS-166) Avail: CFSTI CSCL 20/6

Refractive index data and some extinction coefficients are provided for the infrared region for the following materials: silicon, germanium, zinc sulfide, cadmium telluride, zinc selenide, silica, calcium fluoride, magnesium fluoride, aluminum oxide, magnesium oxide, aluminum, gold and silver. The dependence of these optical constants on wavelength, temperature, crystal form, film preparation technique, radiation and other factors is included. Author (TAB)

N70-36366# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CALCULATING AN ACOUSTIC FIELD IN LAMINAR-HETEROGENEOUS MEDIA

V. M. Kudryashov 25 Nov. 1969 24 p refs Transl. into ENGLISH from Tr. Arkticheskiy i Antarkt. (Leningrad), v. 284, 1968 p 5–18
(AD-700342; FTD-HT-23-439-69) Avail: CFSTI CSCL 20/1

A method for calculating acoustic fields in channels is presented. It is assumed that the channel is filled with a medium which has no shear elasticity and which is nonhomogeneous in the laminar sense. The method is based on the postulate that the selection of the field components, the sum of which describes this field, closely correspond to the spatial structure of the acoustic field, thus facilitating the computation. The acoustic field in the channel is described by a finite number of components, each of which is in turn described by a converging integral. This technique is particularly useful when the acoustic field has a zonal structure, allowing for faster and simpler calculations, than would be possible using the conventional method of plane waves. The acoustic field was computed for the region of the refractive geometric shadow in the channel. TAB

N70-36376*# Bolt, Beranek, and Newman, Inc., Van Nuys, Calif.
TECHNIQUES FOR IMPROVING THE LOW-FREQUENCY PERFORMANCE OF SMALL REVERBERATION CHAMBERS
Terry D. Scharton, Peter E. Rentz, David Lubman, and Pritchard H. White [1970] 52 p refs
(Contract NAS5-21003)
(NASA-CR-112407) Avail: CFSTI CSCL 20A

The design and evaluation of two chamber configurations, a small rectangular concrete block reverberation chamber and a truncated chamber, are described. The following techniques for performance improvement are discussed: (1) Honeycomb panels were placed inside the chamber to enrich the apparent acoustic modal density; (2) absorption was added to increase the modal overlap at low frequencies; (3) feedback devices were used in an attempt to increase the reverberation time, and (4) multiple uncorrelated sources were used in an attempt to smooth the frequency and spatial response of the chamber. Guides for designing reverberation chambers are presented, and predictions are presented for the performance of 2135 cubic feet concrete wall and steel wall reverberation chambers. P.A.B.

N70-36420# Air Force Systems Command, Wright-Patterson AFB, Foreign Technology Div.
ALL-UNION CONFERENCE ON ACOUSTICS
N. I. Alekseeva 6 Nov. 1969 9 p Transl. into ENGLISH from Sudostroenie (USSR), v. 58, no. 6, 1968 p 60–61
(AD-700474; FTD-HT-23-479-69) Avail: CFSTI CSCL 20/1

The sixth All-Union Conference on Acoustics, dedicated to Soviet achievements in acoustics during the last fifty years, has been held in Moscow (date not given). The nearly 800 papers presented by Soviet and foreign scientists at the plenary session dealt mainly with basic problems in modern acoustics and ocean acoustics, the propagation of sound waves in solid structures under the effects of dispersion and losses, the technology of ultrasound and its effect on matter, noise suppressor theory, the use of electronic computers and the application of the theory of algorithms for acoustic calculations, and vibration damping. Author (TAB)

N70-36425# Lamont Geological Observarory, Palisades, N.Y.
THE INTEGRAL SOLUTION OF THE SOUND FIELD IN A MULTILAYERED LIQUID-SOLID HALF-SPACE WITH NUMERICAL COMPUTATIONS FOR LOW-FREQUENCY PROPAGATION IN THE ARCTIC OCEAN
Henry W. Kutschale Feb. 1970 71 p refs
(Contract N00014-67-A-0108-0016)
(AD-704493; TR-1) Avail: CFSTI CSCL 20/1

The report develops by matrix methods the integral solution of the wave equation for point sources of harmonic waves in a liquid layer of a multilayered liquid-solid half space in a form convenient for numerical computation on a high-speed digital computer. Only the case is considered of a high-speed liquid bottom underlying the stack of layers. The integral over wave number has singularities in the integrand and is conveniently transformed into the complex plane. By a proper choice of contours, complex poles are displaced to an unused sheet of the two-leaved Riemann surface, and the integral solution for the multilayered system reduces to a sum of normal modes plus the sum of two integrals, one along the real axis and the other along the imaginary axis. Both integrals are evaluated by a Gaussian quadrature formula. Sample computations are presented for low-frequency propagation in the Arctic Ocean sound channel. These are preliminary computations and the ice layer, which averages three meters in thickness, is not included in the layered system. The effects of the ice layer on propagation are currently under investigation. Author (TAB)

N70-36441*# North Carolina State Univ., Raleigh.
RESULTS OF LIGHT REFLECTANCE MEASUREMENTS FROM ROUGH SURFACES
In its Study of Rectangular-Guide-Like Struct. for Millimeter Wave Transmission 15 Jun. 1970 p 13–30 refs (See N70-36439 20-07)
Avail: CFSTI CSCL 20F

Experimental results are presented in support of the theory that for a surface containing irregularities, light is reflected at an angle to the normal equal to the incident angle but the diffused light is scattered in all directions. A description is given of the preparation of the surfaces and the equipment used to measure the reflectance. E.M.C.

N70-36469+ Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
SOUND LEVEL MEASUREMENTS, OCTAVE BAND AND PERCENT BAND ANALYSIS OF THE NOISE OBSERVED IN GLASS INDUSTRY [MEDIDAS DE NIVEIS GLOBAIS, ANALISE EM FAIXAS DE OITAVAS E EM FAIXA PERCENTUAL DO BARULHO OBSERVADO EM INDUSTRIA DE VIDRO TEMPERADO]
L. X. Nepomuceno 18 Sep. 1969 26 p refs In PORTUGUESE, ENGLISH summary
(Rept-6909.34) Avail: CFSTI

A description is given of the place where the measurements are made, the equipment, accessories and adopted procedure. The results are presented in tabular form, indicating the global levels in the different scales, values in the octave band analysis, and the graphic percentual spectrum from 20 Mz to 20.000 Hz, in the different points observed inside the industry. Also given is a comparison between the actual situation and the legal impositions, with suggestions for the recommended procedure for the solution of the problem in a long term program. Author

N70-36506# Aerospace Corp., El Segundo, Calif. Lab. Operations.
A PRIMER ON THE CONTINUUM THEORY OF DISLOCATIONS, REPORT FOR FEBRUARY–JULY 1968
James D. Guch 1 Feb. 1970 60 p refs
(Contract F04701-69-C-0066)
(AD-704589; TR-0066(9250-03)-1; SAMSO-TR-70-109) Avail: CFSTI CSCL 20/12

The basis of the formal theory of the tensor description of dislocation theory is presented in an unpretentious, yet fairly rigorous, fashion for the purpose of establishing a mutual language of communication between the disciplines of applied mechanics and materials science. Examples illustrating the types of problems that can be solved and the techniques for solving these problems are given. The resulting simplifications are noted in the normally difficult solution for stress caused by a prismatic dislocation loop. Author (TAB)

N70-36573# Naval Postgraduate School, Monterey, Calif.
AN EXPERIMENTAL BICONVEX LIQUID FILLED ACOUSTIC LENS
Jackie Lee Roudebush (M.S. Thesis) Jun. 1969 56 p refs
(AD-705070) Avail: CFSTI CSCL 20/1

An experimental study has been made of the properties of a biconvex liquid-filled acoustic lens formed by pressurizing a refracting fluid between two deformable diaphragms. Trichlorotrifluoroethane was used as the refracting liquid and stainless steel sheets 76 cm in diameter and 0.3 mm (0.012 inch) thick were used as the diaphragm material. Distortion of the spherical surfaces due to the weight of the liquid was negligible because of the tension developed by the internal hydrostatic pressure (1.4 atmospheres for focal length 1.2 meters). Acoustic diffraction patterns measured at f/4.0 in water at frequencies from 200 KHz to 500 KHz compare favorably with patterns computed numerically. Multiple focal points were found and can be associated with multiple internal reflections. Author (TAB)

N70-36612*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ACOUSTIC ENVIRONMENT CHARACTERISTICS OF THE SPACE SHUTTLE
Jess H. Jones *In its* Space Transportation System Technol. Symp. Vol. 2 Jul. 1970 p 285–300 refs (See N70-36595 20-32)
Avail: CFSTI CSCL 20A

Two problem areas in the science of acoustics with regard to the space shuttle are discussed: the rocket engine environment developed during the trans- and supersonic space shuttle exit flight regime. The results of the preliminary analysis of the acoustic environmental characteristics of the space shuttle system are presented. A specific aerodynamic phenomenon, referred to as the high altitude plume induced flow separation phenomena, is presented and discussed in relation to its possible influence on the space shuttle system. Author

N70-36622 European Organization for Nuclear Research, Geneva (Switzerland). Machine Div.
A MATHEMATICAL MODEL FOR UNDERSTANDING THE CROSS MODE EXCITATIONS IN DEE-DUMMY DEE STRUCTURES OF SYNCHRO-CYCLOTRONS
O. M. Bucci (Naples Univ.) and G. Franceschetti (Naples Univ.) 30 Apr. 1970 30 p refs
(CERN-70-13) Copyright. Avail: Issuing Activity

A procedure for studying the cross-mode excitation in the Dee-Dummy Dee (D-DD) accelerating structure in synchrocyclotrons is proposed which takes into account the tapering of the transversal dimensions. To find the theoretical explanation to the excitation the following points were solved: (1) develop a mathematical model of the D-DD structure, (2) find whether or not the model will support cross modes, (3) find the free resonances of the cross mode, (4) find a mathematical model for the mechanism by which the beam can excite the cross mode. The results of the theoretical computation of the cross-mode resonance is in agreement with the actual measurement. F.O.S.

N70-36758*# Naval Research Lab., Washington, D.C.
LIGHT SOURCES FOR STELLAR TELESCOPE CALIBRATION FROM 700 TO 7000 ANGSTROMS
Willem R. Hunter *In* NASA. Washington Opt. Telescope Technol. 1970 p 767–774 refs (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 20F

The radiation sources available for calibrating instruments in the wavelength region of 700 to 7000 A are discussed. Synchrotron radiation is useful over the entire spectral range and requires no standardization. Electrical discharges in gases are used for vacuum ultraviolet and tungsten-ribbon lamps and the carbon arc is used for the near ultraviolet, visible, and near infrared, although these sources require frequent calibration against a known source because of difficulty in standardizing them. Author

N70-36815# Queens Univ., Kingston (Ontario). Dept. of Electrical Engineering.
SOME OPTICAL CORRELATORS
E. Barry Felstead Apr. 1970 151 p ref
(Contract DSS-OPJ9-6; Grant DRB-G-3801-41)
(RR-70-2) Avail: CFSTI

The material presented includes two main subjects: (1) extensions and improvements to the linear real-time optical cross-correlator; and (2) a form of correlation, squaring correlation, and its optical implementation. The squaring correlation function of two complex functions is defined. A general theory for Slobodin's linear optical correlator is presented, followed by three extensions: (1) the amplitude variation of one input spatial signal may be implemented by spatial variations of the aperture width; (2) the correlator's SNR may be improved by suitably modifying the spatial carrier on one spatial input function; and (3) the correlator is immune to the effects of the lenses' aberrations. For completeness, input devices, operation with incoherent sources, and SNR are discussed. Several applications other than original one of pulse compression for radar are suggested. The experimental results demonstrate the validity of the three new extensions. Author

N70-36821# Pittsburgh Univ., Pa. Dept. of Physics.
PROBLEMS OF STABILITY FOR QUANTUM FIELDS IN EXTERNAL TIME-DEPENDENT POTENTIALS
Bert Schroer, Rudolf Seiler, and Jorge Andre Swieca (Sao Paulo Univ.) Dec. 1969 39 p refs Prepared in cooperation with Sao Paulo Univ.
(Contract AT(30-1)-3829)
(NYO-3829-44) Avail: CFSTI

Existence proofs are given for the unitary time evolution operator for various quantized fields interacting with external fields. For interactions finitely extended in time there are no problems with indefinite metric provided certain conditions are met. The Rarita–Schwinger and Pauli–Fierz equations are of this type. In the case of interactions $s > or = to 3/2$ these equations have the well known consistency and causality troubles. Other equations, for example, the Joos–Weinberg equation, are shown to lead to different troubles. Author (NSA)

N70-36872# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
THEORY OF STOKES PULSE SHAPES IN TRANSIENT STIMULATED RAMAN SCATTERING
R. L. Carman, F. Shimizu, C. S. Wang, and N. Bloembergen Jan. 1970 43 p refs
(Contracts N00014-67-A-0298-0006; DAHC04-68-C-0037; N00014-67-A-0298-0005; N00014-67-A-0298-0008)
(AD-704182; TR-603 Avail: CFSTI CSCL 20/6

The theory of transient stimulated Raman scattering has been extended to include an arbitrary shape of the laser pump pulse. It is shown that the maximum Stokes gain depends on the total energy content per unit area of the pump pulse, and not on the instantaneous intensity for an exciting pulse of short duration. The Stokes pulse has a leading edge which rises sharply to a maximum, where the maximum occurs with some delay with respect to the maximum of the pump pulse. The trailing edge follows the decay of the pump. In a nondispersive medium, the gain is not reduced by frequency broadening of the laser output, while in a dispersive medium, considerable gain reduction is expected. Numerical results for various laser pulse shapes and spectral distributions are presented. Author (TAB)

N70-36880*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Space Sciences Div.
PHYSICS
In its Space Programs Sum. No. 37-62, Vol. 3 30 Apr. 1970 p 32–56 refs (See N70-36876 20-34)
Copyright. Avail: CFSTI CSCL 20H

Investigations in molecular physics, supersonic flows, and magnetospheric flow are reported. The ion-molecule reactions in hydrogen-methane mixtures were studied with ion cyclotron single and double resonance techniques, and a variety of condensation, atom exchange, and charge transfer reactions were noted. Studies are presented of the vibrational excitation of molecular hydrogen by low and medium energy electrons, and calculations with semi-empirical potential give good agreement with experimental elastic cross sections and fair agreement with vibrational cross sections. Vibrational excitations of molecular nitrogen and carbon monoxide by electron impact in the atmosphere were also investigated, and electron impact cross sections, and vibrational transition intensities/elastic scattering intensity ratios were determined. Boundary layer transition was studied in a wind tunnel at Mach numbers of 2.2, 3.0, and 4.5, and resulting flow fluctuations are discussed. A two dimensional magnetospheric model was used to determine the magnetospheric response to solar wind fluctuations, and the result indicates that erosive action of the solar wind is the primary agent driving large scale flows. N.E.N.

N70-36962# Lockheed Missiles and Space Co., Palo Alto, Calif.
ELECTRICALLY CONTROLLED DEFLECTION OF A LIGHT BEAM DURING ITS TOTAL REFLECTION IN A BIREFRINGENT ELECTROOPTICAL CRYSTAL
V. A. Shamburov 1970 4 p refs Transl. into ENGLISH from Zh. Prikl. Spektrosk. (USSR), v. 12, no. 5, 1970 p 884–887
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The possibility of an electrically controlled deflection of a light beam refracted on the interface between two media was indicated previously, if at least one of the media possesses an electrooptical effect. An analogous possibility holds also in the total internal reflection of a beam in a birefringent crystal possessing the electrooptical effect. This possibility is presented along with solutions and possible uses. Author

N70-37092# Scientific Translation Service, Ann Arbor, Mich.
NON-STATIONARY INTEGRO-DIFFERENTIAL TRANSPORT EQUATION
S. F. Morozov [1969] 11 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Mat. (Kazan), no. 1, 1969 p 26–31
Prepared for Argonne Natl. Lab.
(ANL-Trans-806) Avail: CFSTI

The theorem of the existence of a solution for the integrodifferential transport equation and the dependence of the differential properties of the solution on the initial conditions are established. The conditions are that the medium in which the reaction takes place is isotropic and homogeneous, that the particle velocities are identical, and that the scattering index can be a function of velocities and of the direction of the velocities and depends only on the cosine of the angle between them. NSA

N70-37119# General Electric Co., Cincinnati, Ohio. Nuclear Systems Programs.
SOLIDUS AND LIQUIDUS TEMPERATURES IN THE UO2-ThO2 SYSTEM
R. E. Latta, E. C. Duderstadt, and R. E. Fryxell AEC Apr. 1970 7 p refs
(Contract AT(40-1)-2847)
(GEMP-734) Avail: CFSTI

Thermal arrest measurements of the solidus and liquidus temperatures were taken for the ThO2–UO2 system in the range of 0 to 17% ThO2. Special attention was given to stoichiometry control during specimen preparation. NSA

N70-37179# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
COMPOST: AN OPTICAL MODEL CODE FOR ELASTIC AND INELASTIC SCATTERING
W. K. Bertram Nov. 1969 14 p refs
(AAEC/TM-524) Avail: AEC Depository Libraries

A description is given of the optical code COMPOST which calculates the elastic and inelastic scattering cross sections of charged or neutral particles with either spin 0 or spin 1/2. The optical potential can either be of the local type or the nonlocal type and may include spin-orbit coupling. Author (NSA)

N70-37193# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Experimentelle Kernphysik.
SOME RESULTS OF COMPUTATIONS CONCERNING THE INFLUENCE OF BENDING FIELD ERRORS ON RESONANT EXTRACTION
J. Erb and G. Merle Mar. 1970 13 p refs
(NP-18225) Avail: AEC Depository Libraries

A brief description of a computer program which simulates approximately the behavior of particles in a synchrotron having nonlinear elements is presented. Some results and conclusions concerning the tolerable limit for the field error for resonant extraction are discussed. NSA

N70-37201# Joint Publications Research Service, Washington, D.C.
PHYSICS AND TECHNOLOGICAL PROGRESS
O. S. Davydov 18 Aug. 1970 13 p refs Transl. into ENGLISH from Visn. Akad. Nauk Ukr. RSR (Kiev), no. 6, Jun. 1970 p 45–54 Presented at the Gen. Meeting of the Acad. of Sci. Ukrain. SSR, Kiev, 11 Mar. 1970
(JPRS-51196) Avail: CFSTI

Longterm progress is reported and discussed in the fields of nuclear power engineering, quantum electronics, including holography, solid state physics, and low temperature physics. P.A.B.

N70-37219# Nebraska Univ., Lincoln. Dept. of Horticulture and Forestry.
SIMULTANEOUS DETERMINATION OF SHORT PERIOD PHOTOSYNTHESIS AND EVAPOTRANSPIRATION Interim Progress Report
Norman J. Rosenburg 21 Nov. 1969 4 p refs
(Grant ESSA-E-293-68(G))
(PB-190124) Avail: CFSTI CSCL 02D

The report contains progress made toward the completion of research for the Simultaneous Determination of Short Period Photosynthesis and Evapotranspiration. Author (USGRDR)

N70-37250# Hamburg Univ. (West Germany).
ASYMPTOTIC LOCALITY AND THE STRUCTURE OF LOCAL INTERNAL SYMMETRIES
Lawrence J. Landau Feb. 1970 29 p refs
(DESY-70/10) Avail: AEC Depository Libraries

Symmetries are investigated from the local viewpoint. Using the Haag–Ruelle construction, the action of a local internal symmetry on the asymptotic states is determined. A condition of asymptotic locality is derived and used to show that the symmetry acts linearly and locally on the asymptotic fields. Within a field theoretical framework it is shown that the internal symmetry must commute with the Poincare group. The general structure of an internal symmetry is determined. The uniqueness of the representation of the Poincare group is discussed, and a simple example of an infinite component field is given to indicate what occurs when there are infinitely degenerate particle multiplets. Author (NSA)

N70-37266# National Bureau of Standards, Washington, D.C.
NBS TECHNICAL HIGHLIGHTS FOR 1969 Annual Report
Mar. 1970 243 p
(PB-190011; NBS-SP-325) Avail: SOD $1.25; CFSTI CSCL 05B

Contents: Computer sciences and research. Basic standards. Materials research. Applied technology, and radiation research. USGRDR

N70-37277# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
PRESENT STATUS OF NONLOCAL AND UNRENORMALIZABLE FIELD THEORY
D.I. Blokhintsev 1970 11 p refs In RUSSIAN
(JINR-P2-4941) Avail: AEC Depository Libraries

The present status of nonlocal and unrenormalizable field theory is reviewed in general on the basis of the works carried out at the Laboratory of Theoretical Physics (JINR). Author (NSA)

N70-37309# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
MAGNETIC PHENOMENA AT METAL SURFACES Technical Progress Report, 1 Jan. – 31 Dec. 1969
Stephen Spooner 23 Feb. 1970 36 p refs
(Contract AT(40-1)-3674)
(ORO-3674-3) Avail: CFSTI

Polarized neutron mirror experiments on magnetic properties of cobalt films and photon scattering measurements in copper crystals are examined. A computerized control system for neutron spectroscopy and diffraction analysis is proposed. A routine coding for the FOCAL program is also discussed. J.A.M.

N70-37389# Weapons Research Establishment, Salisbury (Australia).
WEAPONS RESEARCH ESTABLISHMENT Annual Report, 1968 – 1969
1969 50 p ref
(NP-18196) Avail: AEC Depository Libraries

Section headings for this report, following a general review, are Project and Research Facilities, Consultation and Services, and Equipment and Techniques. Information on external publications and Weapons Research Establishment staff is appended. NSA

N70-37494*# Oklahoma Univ., Norman, Okla. Dept. of Physics.
A NEW TECHNIQUE FOR MEASURING OSCILLATOR STRENGTHS IN THE UV
R.A. Day [1970] 12 p refs
(Grants NGR-37-003-026; NGR-37-003-047)
(NASA-CR-112845) Avail: CFSTI CSCL 20H

The theory of an interferometer with no transmitting elements is described. The instrument utilizes the interference between a set of multiple beams to produce a set of fringes in the exit plane of the interferometer. The anamalous behavior of the index of refraction in the neighborhood of spectral lines is discussed, and the method of determining the product of oscillator strength and population density by measuring the fractional change in the fringe spacing is described. N.E.N.

N70-37565*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PRODUCT MEAN VALUES AND CONVECTION SPEED
W.H. Heybey 12 Sep. 1969 19 p
(NASA-TM-X-53909; MSFC-IN-AERO-67-8) Avail: CFSTI CSCL 20F

The approach used in crossed-beam methodology to explain the relationship of the beam intensity covariances and local extinction coefficient covariances is reviewed. The answer suggested places more weight on experimental determination of correlation volumes and flow direction than on mathematical conditions imposed on the turbulent state. Application is made to the calculation of convection velocity. Author

N70-37590# McGill Univ., Montreal (Quebec). MacDonald Physics Lab.
ACOUSTIC ATTENUATION IN SEA ICE, PART 1. REFLECTION OF SOUND AT THE WATER-ICE INTERFACE, PART 2 Final Report
M. P. Langleben and E. R. Pounder May 1970 33 p refs
(Contract Nonr-4915(00))
(AD-707059; S-16-Pt-1-2) Avail: CFSTI CSCL 8/12

Measurements of the attenuation of acoustic waves in sea ice at frequencies between 10 kHz and 500 kHz were made on the ice cover at Tanquary Fiord, Ellesmere Island (latitude 81 degrees 25 min N, longitude 76 degrees 50 min W) during April-May in 1967 and again in 1969. A horizontal transmission path at a depth of 4 ft, mid-way between the top and bottom surfaces of the ice cover, was used at ranges of 4 ft to 25 ft between piezoelectric transducers immersed in oil-filled bore holes. In an auxiliary experiment in 1969, measurements of the specular reflection of water-borne sound at the water-sea ice interface were made as a function of angle of incidence. The geometric configuration was such that a constant path aligned carefully at each angle of incidence to match this configuration thus obviating the necessity of having to make corrections for range and for directionality characteristics of the transducers. The amplitude reflection coefficient was found to have a value near 0.1 for near-normal angles of incidence but its value was found to increase rapidly with increasing angle of incidence beyond 30 degrees. Author (TAB)

N70-37593# Grumman Aircraft Engineering Corp., Bethpage, N.Y. Research Dept.
TRANSITION RADIATION FROM A PARTICLE TAKING INTO ACCOUNT THE MAGNETIC CHARGE
O. S. Mergelian Jul. 1970 9 p refs Transl. into ENGLISH from Publ. of the Acad. of Sci. of the Armenian SSR (USSR), vol. 36, 1963 p 1 – 8
(TR-57) Avail: CFSTI

The characteristic features the transition radiation from a magnetic charge must have, and ways in which these can be utilized for discovery of the magnetic charge, are examined. A particle simultaneously carrying an electric and a magnetic charge is considered. Fields and currents are expressed in terms of Fourier integrals, and equations for the radiation field are developed. P.A.B.

N70-37596# Radiation Research Associates, Inc., Fort Worth, Tex.
FLASH: A MONTE CARLO PROCEDURE FOR USE IN CALCULATING LIGHT SCATTERING IN A SPHERICAL SHELL ATMOSPHERE Final Report, 1 May 1967 – 31 Jan. 1970
Dave G. Collins and Michael B. Wells 31 Jan. 1970 57 p refs
(Contract F19628-67-C-0298)
(AD-706120; RRA-T704; AFCRL-70-0206) Avail: CFSTI CSCL 20/6

A program designated FLASH has been developed to provide a means to study the propagation of monochromatic radiation from a plane parallel source through a spherical shell atmosphere. A simple illustration of the backward Monte Carlo method utilized in the development of the FLASH program is discussed in order to show the advantage of the method. A brief description of the methods employed in the FLASH program is given to illustrate the application of the backward Monte Carlo treatment of light propagation through a spherical shell atmosphere. Several comparisons of FLASH generated data with data from other calculational methods are shown. Author (TAB)

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N70-36295 National Lending Library for Science and Technology, Boston Spa (England).
USE OF RADIOACTIVE SOURCES OF SOFT X-RADIATION FOR MEASURING THE THICKNESS OF THIN FILMS
S. I. Lobov 29 May 1970 7 p refs Transl. into ENGLISH from Pribory i Tekhn. Eksperim. (Moscow), no. 1, 1969 p 180–184 In ENGLISH and RUSSIAN
(NLL-Windscale-Trans-403-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.

Radioactive sources of soft X-radiation with T and Fe-55 were used to measure thin metal films of 0.01 - 5 mg/sq cm. The thickness of the films was determined by the intensity of the characteristic or scattered X-radiation of the backing material, the backing with the film applied, and the film material. A simple system of recording the radiation with a Geiger counter was used. Film thicknesses were measured for the following combinations of metals: Cu on Al, Al on Fe and Ti, Cd on Ti, Au on Sn and Ag, Au on Fe. The maximum absolute sensitovity for the series of combinations amounted to 5 microgram/sq cm. The sensitivity was determined from variations of the counting rate by 1%. Author

N70-36393# Eidgenossische Technische Hochschule, Zurich (Switzerland).
ELASTIC AND INELASTIC SCATTERING OF 14.1 MeV NEUTRONS ON O-16 AND O-18 [ELASTISCHE UND INELASTISCHE STREUUNG VON 14, 1-MeV-NEUTRONEN AN O-16 UND O-18]
Dieter Meier (Ph.D. Thesis) Basel 1969 28 p refs In GERMAN; ENGLISH summary
(Diss-4292) Avail: CFSTI

Angular distributions for elastic and inelastic scattering of 14.1 MeV neutrons by O-16 and O-18 have been measured in the angular range 7.5 deg smaller than phi smaller than 155 deg using a fast time-of-flight spectrometer and targets of H2O-16,D2O-16, and D2O-18. Absolute differential cross sections were determined for the states or groups of states at 0,6.1,7 MeV in O-16 and at 0,1.98,3.7,5.3 MeV in O-18 as well as the integrated cross sections for these levels and the levels at 6.3,7.12,7.62 MeV in O-18. The results are compared with optical model predictions and direct interaction theories. In the case of O-16, the experimental data are in good agreement with previous work. The angular distribution for neutrons inelastically scattered to the 6.1 MeV state differs from the corresponding proton data and is not well reproduced by theoretical curves. For O-18 appreciably larger scattering cross sections were observed for Q = 0 and −1.98 MeV than incomparable proton measurements. It may be concluded, that the averaging over the level structure in these light nuclei is not sufficient. In a supplementary measurement the total cross section for O-18 has been determined by a transmission experiment to 1610 + or − 70 mb, which is considerably higher than the previously reported value. Author

N70-36523# Kyoto Univ. (Japan). Research Inst. for Fundamental Physics.
PROPAGATORS OF HIGHER SPIN PARTICLES WITH SELF ENERGY PARTS
Yoichi Iwasaki Jun. 1970 17 p refs
(RIFP-105) Avail: CFSTI

The consistency conditions for the propagators of higher spin particles are discussed. Propagators are introduced with O (4) symmetry which satisfy this condition. These dressed propagators have poles at lower partial waves, which means that higher spin particles cannot exist alone, but must be accompanied with lower spin particles. These particles correspond to the abnormal solutions of the B-S equation. The difficulty of the scalar-tensor theory is also discussed. Author

N70-36585# Tokyo Univ. of Education (Japan). Dept. of Physics.
DUAL RESONANCE MODEL AND EXTENDED PARTICLE MODEL WITH ARBITRARY NUMBER OF QUARK-ANTIQUARK PAIRS
Kimio Fujimura (Waseda Univ., Tokyo) and Tsunehiro Kobayashi [1970] 6 p refs
(TUEP-70-11) Avail: CFSTI

It is shown that a dual resonance model can be represented in an extended particle model. Meson-meson scattering, where spin-unitary spin indices of quarks are neglected, is discussed. A tree diagram and remarks on the generalized vertex are included in the discussion. E.H.W.

N70-36588# Tokyo Univ. of Education (Japan). Dept. of Physics.
DEEP INELASTIC STRUCTURE OF e-p SCATTERING AND RELATIVISTIC EXTENDED PARTICLE MODEL BASED ON THE QUARK MODEL
Kimio Fujimura (Waseda Univ., Tokyo) and Tsunehiro Kobayashi Jul. 1970 27 p refs
(TUEP-70-15) Avail: CFSTI

The structure functions for deep inelastic electron-proton scattering are investigated in a quark model with relativistic extended internal structure. Bjorken's conjecture for the structure functions, W sub 1 and W sub 2, are reproduced under a condition for the total decay widths of resonances. The ratio sigma sub L/sigma sub T and MW sub 1/W sub 2 are studied for the test of current in the model. The level structure of resonances is also discussed. Author

N70-36589# Tokyo Univ. of Education (Japan). Dept. of Physics.
EXTENDED PARTICLE MODEL BASED ON THE QUARK MODEL WITH ARBITRARY NUMBER OF QUARK-ANTIQUARK PAIRS
Kimio Fujimura (Waseda Univ., Tokyo) and Tsunehiro Kobayashi [1970] 14 p refs
(TUEP-70-10) Avail: CFSTI

A model is proposed where arbitrary number of internal oscillator freedom is introduced by describing the hadrons as extended particles with arbitrary number of quark-antiquark pairs. The model is applied to the electromagnetic form factor of nucleons. It is also shown that the theoretical form factors in the model have a simple pole near the mass of the vector mesons in the time like region of the momentum transfer. Author

N70-36630# Tokyo Univ. of Education (Japan). Dept. of Physics.
PROPER TIME FORMULATION FOR THE GENERAL DUAL AMPLITUDE
Tsunehiro Kobayashi [1970] 5 p refs
(TUEP-70-16) Avail: CFSTI

To construct a lagrangian formulation for dual resonance models, the dual diagram with the general vertex must be described with the same formulation. Using this proposal, the general dual amplitude with the general vertex in the proper time formulation is derived. Author

N70-36659*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INTERACTION OF INTERMEDIATE ENERGY PROTONS WITH LIGHT NUCLEI

W. K. Roberts, J. S. Vincent, E. T Boschitz, K. Gutow, M. Blecher et al Washington Aug. 1970 57 p refs
(NASA-TN-D-5961; E-5430) Avail: CFSTI CSCL 20H

The elastic and quasi-elastic scattering of 600-MeV protons from light nuclei was studied at the NASA Space Radiation Effects Laboratory (SREL) synchrocyclotron. Differential cross sections have been obtained for the scattering of protons from hydrogen, deuterium, helium 3, and helium 4. Polarization was measured for deuterium and He-4 nuclei. The p/p cross section data are in excellent agreement with the predictions from the Livermore phase shifts. Small-angle p/D, p/He-3, and p/He-4 elastic scattering data are compared with calculations based on the multiple scattering theories of Watson and of Glauber. Large-angle p/D data are compared with the predictions of a model recently proposed by Kerman and Kisslinger. Quasi-free p/D scattering differential cross sections at 12 deg in the laboratory have been measured for nine nuclei between atomic numbers A = 3 and A = 208 and follow very closely a cubic root of A dependence. Author

N70-36661# Scientific Translation Service, Ann Arbor, Mich.
STUDIES OF THE MECHANISM OF NEUTRON CAPTURE IN THE RESONANCE REGION [UNTERSUCHUNGEN DES EINFANGMECHANISMUS VON NEUTRONEN IM RESONANZBEREICH]
Hans-Ulrich Gersch Mar. 1970 31 p refs Transl. into ENGLISH from Deut. Akad. der Miss. Zu Berlin, Zentralinst. fuer Kernforsch. Rossendorf Report ZFK-136, Sect. 3, 3.1, and 3.2 p 37–58 Prepared for Argonne Natl. Lab.
(ANL-Trans-811; STS-8449; ZFK-136) Avail: CFSTI

The study of the mechanism of neutron capture in the resonance region covers experimental methods to determine channel capture, including the anomalous behavior of the intensities of primary gamma transitions and a comparison of the (n, gamma) and the (d,p) reaction in the same nuclide. NSA

N70-36673*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.
MOLECULAR BEAM FOCUSING OF DIATOMICS IN SELECTED STATES: TWO NEW METHODS
Theodore Gustav Waech (Ph.D. Thesis) 16 Oct. 1968 182 p refs
(Grant NSG-275-62; Contracts NOw-61-0604-c; AT(11-1)-1328; Grant NSF GP-7409)
(NASA-CR-112680; WIS-TCI-325-X) Avail: CFSTI CSCL 20H

Two methods were developed for the focusing and state selection of diatomic molecules in thermal molecular beams. The first utilizes a pair of four-pole electric fields, with an interposed crossed beam of microwaves, to select beams of chosen vibrational – rotational states. No mechanical velocity selector is needed. The second (requiring a selector) involves a ten-pole electric field that allows weak focusing and selection of rotational states of negative (or positive) Stark energy, including the "rotationless" state J,M = 0,0. A computer program for a polynomial fit to H + H interatomic potentials is included. Author (NSA)

N70-36787# Oslo Univ. (Norway). Inst. of Physics.
MODIFICATIONS OF THE DOUBLET ENERGY FORMULAE OF A DIATOMIC MOLECULE NECESSITATED BY THE ROTATIONAL STRETCHING
L. Veseth [1969] 27 p refs
Avail: CFSTI

The anomalies found in the spin-splitting of a number of 2 sigma states of diatomic molecules are explained by taking the rotational stretching (centrifugal distortion) of the molecule into account by using an adequate quantum mechanical treatment. This calculation also yields both the true rotational dependence of the parameters p and q describing the lambda - doubling of the 2 pi states, and the centrifugal distortion correction terms to the rotational energy. For the 2 pi states the dependence of the spin-orbit coupling constant A on the internuclear distance gives rise to an additional correction term to the energy of the form A sub J J(J+1). An expression for the parameter A sub J in terms of spectroscopic quantities where values are usually known is derived, and tested for several examples. Author

N70-36799# Japan Atomic Energy Research Inst., Tokai. Physics Div.
STAX2: A COMPUTER PROGRAM FOR CALCULATING NEUTRON ELASTIC AND INELASTIC SCATTERING CROSS SECTIONS BY MEANS OF THE OPTICAL MODEL AND MOLDAUER'S THEORY
Yoshiaki Tomita Jul. 1970 28 p refs
(JAERI-1191) Avail: CFSTI

This program computes the cross sections for neutron elastic and inelastic scattering using the optical model and Moldauer's theory, and searches for potential parameters which reproduce experimental cross sections. Improvement is made in the treatment of the effect of resonance interference. The quantity Q characterizing this effect was regarded as an arbitrary parameter in the calculations hitherto published. In the present program this quantity can be calculated considering its dependence on the strength function. Calculation using the Hauser-Feshbach theory is also possible. Author

N70-36800*# Purdue Univ., Lafayette, Ind. Dept. of Physics.
DETERMINATION OF THE E2/MI MULTIPOLE MIXING RATIOS OF THE GAMMA TRANSITIONS IN Cd 110
K. S. Krane and R. M. Steffen [1969] 32 p refs Sponsored in part by NASA
(Contract AT(11-1)-1746)
(NASA-CR-112354; COO-7148-31) Avail: CFSTI CSCL 20H

The multipole character and E2/M1 mixing ratios of all gamma transitions following the decay of Ag-110m to Cd-110 were determined by measuring the 1-2, 1-3, and 1-4 directional correlations using two 30cc coaxial Ge(Li) detectors in conjunction with a multichannel coincidence gating system. The analysis of the data clearly demonstrated the necessity for careful investigations of clearly demonstrated the necessity for careful investigations of the effects of the Compton background on directional correlation functions for mixed gamma-gamma cascades are given in terms of explicitly defined reduced matrix elements and their ratios delta(gamma neutron). The analysis of the 25 measured directional correlations yielded a consistent set of E2/M1 mixing ratios for all mixed multipole transitions. Author

N70-36818*# Oak Ridge National Lab., Neutron Physics Div.
THE ABSORBED DOSE AND DOSE EQUIVALENT FROM NEUTRONS IN THE ENERGY RANGE 60 TO 3000 MeV AND PROTONS IN THE ENERGY RANGE 400 TO 3000 MeV
R. G. Alsmiller, Jr., T. W. Armstong, and W. A. Coleman 20 Mar. 1970 63 p refs Submitted for publication
(NASA Order H-38280A)
(NASA-CR-112353; ORNL-TM-2924) Avail: CFSTI CSCL 20H

Nucleon-meson cascade calculations have been carried out for monoenergetic neutrons (60 to 3000 MeV) and protons (400 to 3000 MeV) normally incident on a semi-infinite slab of tissue 30-cm thick, and the absorbed dose and dose equivalent as a function of depth in the tissue are presented. The calculated absorbed doses from 180- and 525-MeV incident neutrons and 660- and 730MeV protons are compared with experimental data. For 525-MeV incident neutrons, the experimental and calculated absorbed doses are in good agreement; but this is not the case with the other comparisons. Author (NSA)

N70-36820# Kyoto Univ. (Japan). Research Inst. for Fundamental Physics.
POSSIBLE DUALITY CONSTRAINTS ON P-WAVE NONLEPTONIC DECAYS
Takeo Inami (Tokyo Univ.), Ken Kawarabayashi, and Shinsaku Kitakado (Tokyo Univ.) Jun. 1970 11 p refs
(RIFP-106) Avail: CFSTI

Assuming minimal exchange degeneracy patterns for mesons and baryons consistent with duality and absence of exotic resonances, an argument is given of possible constraints on P-wave nonleptonic baryon decays. Author

N70-36926*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
ENERGY SPECTRUMS FOR PROTON (200 eV < OR = E < OR = 1 MeV) INTENSITIES IN THE OUTER RADIATION ZONE
G. Pizzella and L. A. Frank Jul. 1970 19 p refs
(Contract NAS5-2054; Grant NGL-16-001-002; Contract N00014-68-A-0196-0003)
(NASA-CR-112865; Rept-70-40) Avail: CFSTI CSCL 20H

The directional, differential spectrums of proton intensities mirroring near the magnetic equator in the outer radiation zone are obtained for the energy range 200 eV < or = E < or = 1 MeV with measurements from the spacecrafts OGO 3, Explorers 12 and 14 and Mariner 4. Several implications of these observational results with respect to current magnetospheric models of diffusion and acceleration mechanisms are discussed. Author

N70-36983# International Centre for Theoretical Physics, Trieste (Italy).
PHONONS, BARYON RESONANCES AND THE HIGH ENERGY, LARGE ANGLE BARYON-BARYON SCATTERING
T. J. Gajdicar and J. C. Huang Apr. 1970 16 p refs Submitted for publication Sponsored in part by Natl. Res. Council of Can.
(IC/70/24) Avail: CFSTI

A model is proposed which assumes that the subparticles or partons of a baryon can produce phonons. The resonance states of the baryons are then interpreted in terms of the number of phonons produced. By summing over all direct channel phonon-produced resonance states, a formalism is developed for high energy, large angle baryon-baryon scattering which is in agreement with the proton-proton scattering data around 90 deg. Author (ESRO)

N70-36987# Oak Ridge National Lab., Tenn.
RICE: A PROGRAM TO CALCULATE PRIMARY RECOIL ATOM SPECTRA FROM ENDF/B DATA
J. D. Jenkins 16 Feb. 1970 38 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2706) Avail: CFSTI

The program, RICE, has been written to calculate the energy exchange probabilities between neutrons and primary recoil atoms in a given material. The program uses the ENDF/B neutron cross section library tapes as its source of basic neutron scattering data. It correctly incorporates information on anisotropic elastic scattering and inelastic scattering into the calculation of the energy exchange matrix. In addition, RICE will calculate damage cross sections, primary recoil atom spectra, and optimum cutoff energies for use in comparing displacement damage in different reactor neutron spectra. Author (NSA)

N70-36990# California Univ., Berkeley. Lawrence Radiation Lab.
NUCLEON-NUCLEON TRIPLE-SCATTERING PARAMETERS 510-670 MeV
Pamela Hansen Surko (Ph.D. Thesis) 15 Jan. 1970 44 p refs
(Contract W-7405-eng-48)
(UCRL-19451) Avail: CFSTI

The values of the Wolfenstein depolarization parameter D are reported at 670, 600, and 520 MeV for the pp interaction, over the cm angular range 30 to 120 deg. The transfer depolarization parameter was measured at 600 and 525 MeV in the free system, over the range 65 to 180 deg cm. Predictions of various phase-shift solutions are compared to the data. A polarized neutron/proton beam was produced by elastically scattering the beam of the Berkeley 184 Cyclotron off deuterium/hydrogen. The polarized beam was elastically scattered off hydrogen and the polarization of the recoil proton analyzed in a carbon-slab and magnetostrictive-wire-chamber array. Author (NSA)

N70-37012# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Reaktorentwicklung.
THE DETERMINATION OF THE FAST FISSION FACTOR OF BERYLLIUM AND BERYLLIUM OXIDE USING A PULSED NEUTRON SOURCE [DIE BESTIMMUNG DES SCHNELLSPALTFAKTORS VON BERYLLIUM UND BERYLLIUMOXYD MIT DER METHODE EINER GEPULSTEN NEUTRONENQUELLE]
Martin Dammeier (Ph.D. Thesis--Tech. Hochschule Aachen) Apr. 1970 103 p refs In GERMAN
(Jul-652-RG) Avail: CFSTI

The good decelerating properties, low neutron absorption and neutron multiplication effect, have promoted the use of beryllium as a moderator, reflector and general material in thermal reactors. The possibility of using beryllium-oxide spheres instead of spherical graphite fuel elements in gas-cooled high temperature reactors was raised so the fast fission factors of Be and BeO were investigated. A new method was developed and its use is discussed. ESRO

N70-37032# Atomic Energy Commission, New York. Health and Safety Lab.
ESTIMATING STRAY PHOTON SPECTRA AND DOSE ABOVE 25 MeV NEAR THE TRANSVERSE SHIELDING OF A PROTON SYNCHROTRON
B. G. Bennett, J. E. McLaughlin, K. O'Brien, and M. S. Weinstein Apr. 1970 14 p refs
(HASL-226) Avail: CFSTI

Several stray photon energy spectra from 25 to 400 MeV were measured at a high energy accelerator with a shower spectrometer consisting of lead spheres and Li-7F dosimeters. The spectra are relatively smooth and decline approximately as E(-3) with increasing energy. The contribution to the total radiation dose equivalent by these energetic photons is provisionally catimated to be about 7%. Though the shower spectrometer system is cumbersome and would benefit from further study of its response, it shows promise for investigating leakage photons at selected locations outside shields. Author (NSA)

N70-37038# International Centre for Theoretical Physics, Trieste (Italy).
BROKEN CHANNELS IN PION(+) PHOTOPRODUCTION ON He-3
R. Guardiola and J. L. Sanchez-Gomez Apr. 1970 17 p refs Submitted for publication Sponsored by Grupo Interuniversitario de Fis. Teorica, Spain
(IC/70/25) Avail: CFSTI

In this paper the reactions gamma + He-3 yields pi (+) + n + d and gamma + He-3 yields pi (+) + n + n + p are studied in the impulse approximation. The angular distributions of the pions as well as the total cross-sections for both reactions are calculated. Final state interaction effects are investigated for the first reaction. Author (ESRO)

N70-37051# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
SOME PROGRAM ELEMENTS FOR GAMMA SPECTROMETRY AND ACTIVATION ANALYSIS [ELEMENTS DE PROGRAMMES EN SPECTROMETRIE GAMMA ET ANALYSE PAR ACTIVATION]
Eric Junod Feb. 1970 88 p refs In FRENCH; ENGLISH summary
(CEA-R-3955) Avail: CFSTI

The use of computers for analyzing scintillation gamma spectrometry data is spreading, particularly in the field of activation analysis. This report presents the basic subprograms or complementary programs, with their FORTRAN lists, which have been established or adapted for constructing a gamma spectra processing system. The general organigram of this system (GASPARD) is given as an example of assembling subprograms.
Author (ESRO)

N70-37057# Oak Ridge National Lab., Tenn.
DISPERSION RELATIONS SATISFIED BY THE NEUTRON WAVE FIELD
M. N. Moore, R. S. Booth, and R. B. Perez 9 Apr. 1970 31 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2942) Avail: CFSTI

It is shown that the inverse square magnitude of the propagation vector for neutron waves satisfies dispersion relations. Differentiation of these relations and evaluation of the resulting integrals at zero frequency lead to a set of equations for determining diffusion and thermalization parameters by performing integrals over experimental data.
Author (NSA)

N70-37059# Syracuse Univ., N.Y. Dept. of Physics.
IMPLICATIONS OF LOCAL DUALITY IN MESON DECOUPLET
M. J. King and Kameshwar C. Wali Mar. 1970 9 p refs
(SU-1206-224; NYO-3399-224) Avail: CFSTI

The consequences of the assumption that the imaginary parts of the direct channel helicity amplitudes vanish in the forward (backward) scattering if the crossed t-channel (u-channel) is exotic, are examined in the case of meson-decuplet scattering. With restriction to a limited energy region above the threshold, it is shown that the solutions of the set of equations provided by different external helicities predict the existence of certain patterns of octet and decuplet baryons degenerate in mass and having spin parity assignments 5/2 + or −, 3/2 + or −, 1/2 + or −.
Author (NSA)

N70-37093# California Univ., Los Angeles. Dept. of Physics.
EXCITATION FUNCTIONS OF PROTON-INDUCED REACTIONS ON OXYGEN AT MEDIUM ENERGIES
Stephen N. Bunker Dec. 1969 145 p refs
(Contract AT(11-1)-Gen-10)
(UCLA-10-P-18-16) Avail: CFSTI

The excitation functions of proton-induced reactions on oxygen between 20 and 40 MeV are discussed. Measurements for the excitation functions of inelastic scattering, (p,d), (p,t) and (alpha) reaction channels are presented. Results of the optical model, coupled-channels theory, and Ericson fluctuation analysis are compared to those of the doorway state theory, which provides a theoretical explanation of resonances at high excitation energies. Also presented are the parameters of resonances and the spin and parity results from the analyses.
NSA

N70-37094# Chicago Univ., Enrico Fermi Inst.
THE PRODUCTION OF MN 54 AND ZN 65 FROM COPPER IN THICK TARGETS BY 0.45 GeV, 1.0 GeV, AND 3.0 GeV PROTONS
A Van Ginneken and Anthony Turkevich [1969] 55 p refs
(Contract AT(11-1)-1167)
(COO-1167-8) Avail: CFSTI

The production of Mn-54 and Zn-65 from copper was measured radiochemically at various depths and radial distances inside thick targets (up to 1m in size) which were irradiated with 0.45-, 1.0- and 3.0-GeV protons. The targets consisted mainly either of copper or iron. Effects of finite beam size vis-a-vis the pencil beam of the calculation are discussed and their inclusion is shown to improve the detailed comparisons. The Monte Carlo calculation has demonstrated the importance of internuclear cascade effects in thick targets; e.g., at 3.0 GeV about 90% of the Mn-54 and virtually all of the Zn-65 is made by other particles than the primary ones. An analysis is presented of the different mechanisms by which a specific product can be made when high energy particles enter large bodies, and the relative contribution of each of these mechanisms to the production of Zn-65 and Mn-54 in copper is evaluated.
Author (NSA)

N70-37096# Oak Ridge National Lab., Tenn.
Ni 60 NEUTRON ELASTIC AND INELASTIC SCATTERING CROSS SECTIONS FROM 6.5 TO 8.5 MeV
F. G. Perey, C. O. Le Rigoleur, and W. E. Kinney Apr. 1970 81 p refs
(Contract W-7405-eng-26)
(ORNL-4523) Avail: CFSTI

Numerical values are given for neutron elastic- and inelastic-scattering cross sections from nickel-60 at five energies from 6.5 to 8.5 MeV. A brief description of the experimental and data-reducing techniques is presented to assist in the evaluation of the data. Angular distributions are given for elastic scattering and inelastic scattering to the low-lying excited states. Above 3 MeV of excitation in the residual nucleus, the experimental energy resolution is inadequate to resolve the inelastic scattering to individual levels. This contiuum protion of the inelastic spectrum presents much structure which is very similar at all the energies. Angular distributions were extracted for the five lowest peaks in this continuum which are about 3.2, 3.7, 4.1, 4.4, and 4.6 MeV of excitation.
Author (NSA)

N70-37098# Princeton-Pennsylvania Accelerator, Princeton, N.J.
CALIBRATION OF A LARGE NEUTRON COUNTER USING THE PION NUCLEON CHARGE EXCHANGE REACTION
K. W. Chen, P. A. Crean, J. T. Dakin, and M. G. Hauser 7 Apr. 1970 28 p refs
(Contract AT(30-1)-2137)
(PPAR-25) Avail: CFSTI

The efficiency of several large liquid scintillation counters for detection of 110 MeV neutrons has been measured in a tagged neutron beam utilizing the negative neutron + proton yields neutron + neutral pion neutron. These measured values have been combined with calculations based on known neutron + proton and neutron + Carbon scattering cross sections to obtain the neutron detection efficiency of these counters from 40 to 400 MeV.
Author (NSA)

N70-37099# Brookhaven National Lab., Upton, N.Y.
MODERN ALCHEMY WITH ACCELERATORS
James B. Cumming 12 Mar. 1969 14 p refs Sponsored by AEC *Its* Lecture Ser. No. 82
(BNL-50211) Avail: CFSTI

A general picture of nuclear reactions at high energies induced by protons is given. The mechanisms that play a role in such reactions are discussed. Experimental studies at GeV energies are described. Semiquantitative analysis of spallation and fission is considered.
NSA

N70-37101# California Univ., La Jolla. Dept. of Physics.
CAUSALITY AND LORENTZ INVARIANCE IN RELATIVISTIC QUANTUM MECHANICS
Yoshiko Ishikawa (Ph.D. Thesis) Feb. 1970 70 p
(Contract AT(11-1)-GEN-10)
(UCSD-10-P-10-69) Avail: CFSTI

In the Fock space of the physical states of a single spinless particle, an attempt is made to construct an interaction Hamiltonian. The following conditions on the Hamiltonian are imposed. It is Hermitian. It does not affect the vacuum and single particle states. The S-matrix given by Dyson's formula is Lorentz invariant. Any interaction Hamiltonian in field theory does not satisfy the second condition, since the Fock space of the theory consists of bare states instead of physical states. As it is the case in field theory, the Lorentz invariance of the S-matrix is possibly attained through an interaction Hamiltonian which can be expressed by the space integral of a causal and Lorentz invariant interaction Hamiltonian density. It is concluded that the properties of S-matrix (Lorentz invariance, analyticity, etc.) do not necessarily require causality and Lorentz invariance of an interaction Hamiltonian density.
Author (NSA)

N70-37102# California Univ., Berkeley. Lawrence Radiation Lab.
SPINORS FROM VECTORS
C. Garwin 18 Mar. 1970 14 p refs
(Contract W-7405-eng-48)
(UCRL-19730) Avail: CFSTI

Working in general at fixed time, spinor quantities are constructed out of vectors. The methods used are not directly applicable to dynamical fields.
Author (NSA)

N70-37103# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Nuclear Science.
A MEASUREMENT OF THE RADIATION WIDTH OF THE 2.85-keV RESONANCE AND OF THE THERMAL CAPTURE CROSS SECTION IN SODIUM
N. Yamamuro, R. W. Hockenbury, R. C. Block, and R. H. Wolfe [1970] 23 p refs
(Contract AT(30-1)-328)
(RPI-328-185) Avail: CFSTI

Neutron radiative capture measurements upon samples of sodium were carried out using a 100-MeV electron linear accelerator. The radiation width of the 2.85-keV resonance was determined to be (0.47 + or − 0.045) eV. The capture cross section in the 0.025 to 0.200 eV energy range had an energy dependence (to an accuracy of + or − 2%), and a capture cross section of (0.50 + or − 0.03) barn was obtained at 0.0253 eV. The measured radiation width of the 2.85-keV resonance is approximately 50% greater than the radiation width that is inferred from the thermal capture cross section.
Author (NSA)

N70-37104# Rice Univ., Houston, Tex.
STUDIES OF THE CROSS SECTIONS OF H 3, HE 3, HE 4, and C 14 IN THE BOMBARDMENT OF CARBON AND OXYGEN WITH HIGH-ENERGY PROTONS Progress Report
D. Heymann and S. T. Kruger 28 Feb. 1970 5 p
(Contract AT(40-1)-3815)
(TID-25379) Avail: CFSTI

A brief review of the studies of the cross sections of H-3, He-3 He-4, and C-14 in the bombardment of carbon and oxygen with high-energy protons at Rice University is presented.
NSA

N70-37114# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
ACTIVATION ANALYSIS: COUNTING OF SHORT HALF-LIFE RADIONUCLIDES. VOLUME 2: PART C: ANALYTICAL PROGRAMS FOR DECAY CURVES [ETUDES D'ANALYSE PAR ACTIVATION: LE COMPTAGE DES RADIONUCLEIDES DE PERIODES COURTES. VOLUME 2: PARTIE C: PROGRAMMES DE DEPOUILLEMENT DES COURBES DE DECROISSANCE]
Eric Junod Jan. 1970 57 p In FRENCH; ENGLISH summary
(CEA-R-2980-Vol-2) Avail: CFSTI

Problems connected with the qualitative and quantitative analysis of the decay curves of a mixture of radioactive sources of which at least one has a short half-life are discussed. A mathematical description is given of six basic processes for which some FORTRAN program elements are proposed. Two supplementary programs were drawn up for treating dosage problems in activation analysis: one concerns the simultaneous irradiation of the sample and one or several known samples, the other with the separate irradiation of the unknown and known samples, a dosimeter (activation, or external) being used for normalizing the irradiation flux conditions.
Author (ESRO)

N70-37117# Battelle Memorial Inst., Columbus, Ohio.
MATHEMATICAL METHODS FOR EVALUATING THE TRANSPORT AND ACCUMULATION OF RADIONUCLIDES
S. G. Bloom, A. A. Levin, W. E. Martin, and G. E. Raines 3 Apr. 1970 40 p refs
(Contract AT(26-1)-171)
(BMI-171-30) Avail: CFSTI

The mathematical methods used for evaluating the transport and accumulation of radionuclides for the radiological feasibility studies are described. Some differential equations for describing the biological transport are derived, and representative methods for obtaining the transfer coefficients are given. Analytical, finite-difference, and semianalytical methods for solving the differential equations are briefly described and a few methods are presented explicitly with examples. The analytical methods include the use of the Laplace transform technique to obtain expressions for the infinite-time radiation dose from internally deposited radionuclides. The mathematical methods are applied toward developing expressions for estimating the internal radiation dose to man which might result from the use of nuclear explosives for excavating craters. The application consists of using a simple but highly conservative mathematical model based on specific activity in order to place an upper bound to the dose from each radionuclide.
NSA

N70-37121# Oak Ridge National Lab., Tenn.
THE 11-MeV PROTON INELASTIC SCATTERING FROM EVEN-EVEN MEDIUM WEIGHT NUCLEI
C. M. Perey, G. J. Silva, J. K. Dickens, and F. G. Perey 29 Jan. 1970 31 p
(ORNL-TM-2861) Avail: CFSTI

The analysis of inelastic scattering of 11 MeV protons from quadrupole and octupole collective levels of 14 even-even nuclei between Ti-48 and Ge-76 is reported. The distorted wave Born approximation is used to calculate the cross sections using the collective model generalization of the optical model for inelastic scattering. The analysis is performed using both real and complex form factors for the model. A satisfactory description of all of the data is obtained when a contribution due to compound nucleus decay for most of the octupole levels and a few of the quadrupole levels is included.
Author (NSA)

N70-37149# Oak Ridge National Lab., Tenn. Neutron Physics Div.
CALCIUM NEUTRON ELASTIC AND INELASTIC SCATTERING CROSS SECTIONS FROM 4.0 TO 8.5 MeV
F. G. Perey and W. E. Kinney Apr. 1970 51 p refs
(Contract W-7405-eng-26)
(ORNL-4519) Avail: CFSTI

Numerical values are given for neutron elastic- and inelastic-scattering cross sections from Ca in the range of 4.0 to 8.5 MeV. A brief description of the experimental and data-reducing techniques is presented to assist in the evaluation of the data. Elastic angular distributions at two energies are in very good agreement with previous data. There does not exist any previous measurement of inelastic scattering with which to compare the data. The data are compared with the present ENDF/B evaluation. Very good agreement is found for elastic scattering. For inelastic scattering the shapes of the angular distributions are in fair agreement, but there are some serious discrepancies in the magnitudes of the cross sections. Author (NSA)

N70-37152# Calif. Univ., Berkeley. Lawrence Radiation Lab.
CHARGE ASYMMETRY IN THE MUONIC DECAY OF THE K SUB 2 (0)
Michael Anthony Paciotti (Ph.D. Thesis) Dec. 1969 105 p refs Sponsored in part by AFOSR
(Contract W-7405-eng-48)
(UCRL-19446) Avail: CFSTI

The charge asymmetry in the muonic decay of K sub 2(0) is measured to be 1.0098 + or − .0032. Separation of muons from pions is achieved by passage through 230 grams/sq cm of aluminum and 870 grams/sq cm of lead. Positive and negative muons are spatially separated behind the pion filter by application of a magnetic field preceding the aluminum and lead absorber. Data are taken with scintillation counters, and optical thin-plate and thick-plate spark chambers are used for calibration of systematic effects. Author (NSA)

N70-37153# Illinois Univ., Urbana.
A MEASUREMENT OF THE DIFFRACTION SCATTERING OF PIONS AND PROTONS FROM COMPLEX NUCLEI USING MULTIWIRE PROPORTIONAL COUNTERS
Yamuel Louis Segler (Ph.D. Thesis) 1970 90 p refs
(Contract AT(11-1)-1195)
(COO-1195-182) Avail: CFSTI

The development and testing of multiwire proportional counters is discussed. The use of a proportional counter system in an experiment to study the diffraction scattering of protons and positive pions from various complex nuclei is considered. A good precision experiment is made considerably simpler due to the high resolution characteristic of the multiwire proportional counters. Proportional counters and the experimental motivation, arrangement of the apparatus, and the experimental measurements and conclusions are presented. The differential and total cross sections for 1 GeV/c positive pion and proton scattering from complex nuclei were measured at the Argonne ZGS. The targets used ware carbon, aluminum, copper, and lead. A combination of scintillation, Cherenkov, and multiwire proportional counters was used to obtain the data. Author (NSA)

N70-37154# Oak Ridge National Lab., Tenn. Neutron Physics Div.
GENERAL METHOD OF IMPORTANCE SAMPLING THE ANGLE OF SCATTERING IN MONTE CARLO CALCULATIONS
Calvin E. Burgart (Ph.D. Thesis) and P. N. Stevens (Tennessee Univ., Knoxville) 3 Mar. 1970 51 p refs Submitted for publication
(Contract W-7405-eng-26)
(ORNL-TM-2890) Avail: CFSTI

The application of the Monte Carlo method to the solution of deep-penetration radiation transport problems requires the use of "importance sampling." A systematic approach to obtaining an importance function is to calculate the solution of the inhomogeneous adjoint transport equation and to use this adjoint flux as the importance function. The adjoint flux is calculated for simplified geometries using one-dimensional discrete ordinates methods. In three-dimensional deep-penetration Monte Carlo calculations the alteration of both the transport and the collision kernel is desirable. The exponential transform is quite useful for altering the transport kernel. However, selection from the altered collision kernel is much more difficult. The approach taken here is to introduce an angular grid with thirty discrete directions fixed in the laboratory coordinate system, along which particles are required to travel. Author (NSA)

N70-37194# Commissariat a l'Energie Atomique, Grenoble (France). Lab. de Physique Nucleaire.
THE n-n AND n-p INTERACTIONS FROM TWO COMPLETE EXPERIMENTS ON THE THREE-NUCLEON REACTION D(n,nnp) AT 14.5 MeV
C. Perrin, J. C. Gondrand, M. Durand, S. Desreumaux, and R. Bouchez Jul. 1969 24 p refs Presented at Intern. Conf. on the Three-Body Probl. in Nucl. and Particle Phys., Birmingham, Engl., 8-10 Jul. 1969 Prepared in cooperation with Grenoble Univ.
(CEA-CONF-1485; CONF-690710-5) Avail: AEC Depository Libraries

Two complete experiments on the reaction d(n,nnp) at 14.5 MeV were performed with the same apparatus: a double time-of-flight spectrometer and a seven parameter analyzer. The nn experiment performed at (+30 deg, +30 deg) angles, near the nn pole, gave 4400 events in the peak. The np experiment at (+30 deg, −80 deg) angles, near the np pole, gave 2800 events in the peak. To analyze simultaneously both peaks, a simulation of both experiments by a Monte-Carlo method was carried out. Independently, a first iteration of the Faddeev equations with a separable potential was also done for the nn experiment. Author (NSA)

N70-37195# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
NUCLEON-MESON MODEL OF BARYONS WITH THE MASS SMALLER THAN 2 GeV
V. F. Dushenko 1970 11 p refs In RUSSIAN
(JINR-P2-4987) Avail: AEC Depository Libraries

Some empirical regularities in the spectrum of baryons of small masses, which are revealed when such baryons are considered to be the compounds of a nucleon-meson system, are discussed. The character of these regularities proves the possibility of existence of a model of the shell type. The systems with mesons pi, kappa, and eta stable with respect to the strong decays are considered. Author (NSA)

N70-37206# Deutsches Elektronon-Synchrotron, Hamburg (West Germany).
PION ELECTROPRODUCTION AND CHOICE OF FRAME IN THE VECTOR MESON DOMINANCE MODEL
C. Iso and D. Schildknecht Feb. 1970 16 p refs Sponsored in part by Stift. Volkswagenwerk Prepared in cooperation with American Univ., Beirut
(DESY-70/11) Avail: AEC Depository Libraries

It is pointed out how forthcoming experiments on electroproduction of pions will provide additional information on the choice of the reference frame to be used to formulate mass extrapolation assumption of the VDM in pion production processes. Author (NSA)

N70-37210# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Neutronenphysik und Reaktortechnik.
EVALUATED MICROSCOPIC NEUTRON CROSS SECTIONS AND 28 GROUP CONSTANTS FOR Cd
H. Bachmann, B. Hinkelmann, B. Krieg, I. Langner, J. J. Schmidt et al Nov. 1969 35 p refs

(EURFNR-749; KFK-1080; EANDC(E)-125-U) Avail: AEC Depository Libraries

Microscopic cross section data for Cd in the energy range 0.001 eV to 15 MeV recently incorporated in the Karlsruhe KEDAK file are described. The fast neutron cross sections were almost exclusively taken over from an evaluation by Drake from GGA with slight changes only in keV capture cross sections. In the thermal and resolved resonance energy ranges the neutron cross sections were recalculated from resonance parameters reevaluated with due account of more recent experimental information. The evaluated microscopic cross sections and resonance parameters have been transferred to and are available from the ENEA/CCDN. From the microscopic cross sections (unshielded) group cross sections in the 26 ABN group structure were calculated using both the neutron spectrum of a fast Na cooled prototype reactor and the neutron spectrum of the ABN group cross section set as weighting spectra. Author (NSA)

N70-37211# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

ROTATIONAL MOTION IN ODD-MASS DEFORMED NUCLEI

M. I. Chernei and N. I. Pyatov 1970 39 p refs In RUSSIAN (JINR-P4-4966) Avail: AEC Depository Libraries

The present status of the theory of rotational motion in odd-mass deformed nuclei is reviewed. Cranking-model description of rotational bands based on intrinsic excited states is considered. Special attention is paid to the effects of coupling of intrinsic and rotational motion which have been revealed recently in nuclear reaction studies. Some nonadiabatical methods are discussed and the examples of nonadiabatic calculations are presented. Author (NSA)

N70-37212# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.

SPECTRUM OF FAST DEUTERONS EMITTED IN THE INTERACTION OF 670-MeV PROTONS WITH CARBON NUCLEI

L. S. Azhgirei, Z. V. Krumshtein, Ngo Kuang Tsui, V. I. Petrukhin, D. M. Khazins et al 1970 24 p refs In RUSSIAN Presented at the 3d Intern. Conf. on High Energy Phys. and Nucl. Struct., N.Y., Sep. 1969

(JINR-P1-4985; Conf.-690914-7) Avail: AEC Depository Libraries

Using the magnetic and the time-of-flight spectrometers the spectrum of deuterons emitted at an angle of 6.5 deg in the interaction of 670 MeV protons with carbon nuclei was measured in the momentum range from 700 to 1700 MeV/c. A new intense channel of the deuteron production (with the pion production) was observed. Author (NSA)

N70-37223# European Space Research Inst., Frascati (Italy).

ANALYSIS OF XUV SPECTRA BY THE METHOD OF BACHER AND GOUDSMIT

J. P. Connerade [1970] 18 p refs Submitted for publication Avail: CFSTI

The applicability of the Bacher and Goudsmit method to the analysis of highly stripped ion spectra in the XUV range was examined. It appears that useful results may be obtained so reducing the need for extensive Hartree-Fock calculations when predictions of wavelength only are required. Author (ESRO)

N70-37248# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.

LEVELS OF Po 202, Po 203, Po 204, Po 205, AND Po 206

T. Morek, R. Broda, W. Walus, Ch. Droste, W. Neubert et al 1969 28 p refs In RUSSIAN (JINR-P6-4868) Avail: AEC Depository Libraries

The levels of the odd and even polonium isotopes were investigated via the K-capture of At(202-206) produced in the reactions Au-197(C-12,xn)At(209-x) and Re-195(Ne-22,xn)At(207-x), respectively. By means of gamma-gamma coincidence and integral conversion electron measurements level schemes are suggested. Prominent gamma ray cascades were found in the even polonium isotopes Po-206:396 keV(E2), 476 keV(E2), 699 keV(E2); Po-204:426 keV(E2), 516 keV(E2), 682 keV(E2) and Po-202:443 keV, 571 keV, 676 keV. By analogy with the level structure in Po-208 and Po-210 these cascades are interpreted as transitions between the levels 6+, 4+, 2+, 0+ of the broken two quasiparticle multiplet (h sub 9/2) squared. For the low excited states in Po-203 and Po-205 spin assignments are presented. Author (NSA)

N70-37251# Oak Ridge National Lab., Tenn.

THE ABSOLUTE SPECTRUM OF PHOTONS EMITTED IN COINCIDENCE WITH THERMAL-NEUTRON FISSION U 235

R. W. Peelle and F. C. Maienschein Apr. 1970 101 p refs (Contract W-7405-eng-26)

(ORNL-4457) Avail: CFSTI

In the measurement, each of three types of NaI(Tl) scintillation spectrometers was operated in coincidence with a fission chamber exposed to thermal neutrons from the Graphite Reactor or the Bulk Shielding Reactor. Detailed and careful construction of the response functions of the spectrometer was based on their exposure to radioactive sources of known disintegration rates. These data were used to unfold the measured pulse-height spectra to give the absolute differential energy spectrum and uncertainty. Output spectra are given with an effective resolution only slightly broader than the inherent energy resolution of the spectrometers except at energies about 5 MeV, where the raw pulse-height bins were made wider than the spectrometer resolution to reduce statistical uncertainties. Combinations of the data into four sets of coarser energy groups are also included to simplify use of these data in computations. The results obtained here are in approximate agreement with previous measurement in the energy region above 100 keV. Author (NSA)

N70-37252# Bettis Atomic Power Lab., Pittsburgh, Pa.

ON THE USE OF EFFECTIVE DELAYED NEUTRON FRACTIONS FOR FEW-GROUP SPACE-TIME ANALYSIS (LWBR DEVELOPMENT PROGRAM)

J. B. Yasinsky and L. R. Foulke Apr. 1970 47 p refs (Contract AT(11-1)-GEN-14)

(WAPD-TM-938) Avail: CFSTI

An examination is made of the energy group dependence of the few-group time-dependent diffusion theory model for multiple fissionable isotope bearing reactors. Specific emphasis is on the adequacy of effective delayed neutron reactions to improve the accuracy of the few-group solutions. Numerical results indicate that space-time independent effective delayed neutron fractions can represent adequately the delayed to prompt neutron importance effects and account for the local presence of two different fissionable isotopes. Author (NSA)

N70-37253# Bettis Atomic Power Lab., Pittsburgh, Pa.

A VERSATILE EIGENVALUE METHOD FOR CALCULATING EFFECTIVE DELAYED NEUTRON RACTION WITH BE-21

K. Foulke, E. Schmidt, and M. Natelson Apr. 1970 13 p refs (Contract AT(11-1)-GEN-14)

(WAPD-TM-941) Avail: CFSTI

A method is described which uses the program BE-21 to calculate effective delayed neutron fraction for individual spatial regions of reactors with more than one fissionable isotope. The chief virtue of the method is that it may be used as a standard for testing other prescriptions for calculating delayed neutron fraction. Example calculations of delayed neutron fraction for a seed-blanket reactor indicate the insensitivity of delayed neutron fraction to flux tilting. Author (NSA)

N70-37257# Hamburg Univ. (West Germany).
NEUTRON-NEUTRON SCATTERING LENGTH FROM A KINEMATICALLY COMPLETE EXPERIMENT ON THE REACTION, n + d YIELDS + N + P
B. Zeitnitz, R. Maschuw, and P. Suhr Feb. 1970 32 p refs
(DESY-70/7) Avail: AEC Depository Libraries

The coincident neutron spectra from the reaction D(n,2n)H at E sub N = 18.5 MeV were measured with a double time-of-flight spectrometer. The data were analyzed in the Watson–Migdal approximation, using a Monte Carlo technique. The results give the singlet neutron-neutron scattering length as approximately – 16.4 fm for 1SO. Author (NSA)

N70-37259# Brookhaven National Lab., Upton, N.Y.
MOGUS: A CODE FOR EVALUATING THE MOTT SCATTERING CROSS SECTION AND THE GOUDSMIT-SAUNDERSON ANGULAR MULTIPLE-SCATTERING DISTRIBUTION FOR USE IN ELECTRON TRANSPORT CALCULATIONS
R. M. Felder Jul. 1969 65 p refs Sponsored by AEC
(BNL-50199(T-549)) Avail: CFSTI

The formulas required for the calculation of the Mott cross section for scattering of electrons by an unscreened nuclear charge and the Goudsmit–Saunderson angular multiple scattering distribution for electrons are summarized, and a FORTRAN-4 code which performs these calculations is given. The occurrence of the calculated quantities in electron transport theory is outlined in an introductory section. Subsequent sections contain a detailed summary of the transport model and analytical expressions for the calculated quantities, an outline of the code, a guide to the use of the code, illustrative results, and the code itself. Author (NSA)

N70-37262# Joint Inst. for Nuclear Research, Dubna (USSR).
STATISTICAL ANALYSIS OF THE SPIN DEPENDENCE OF THE NEUTRON STRENGTH FUNCTION OF THE NUCLEUS
Kh. Maletski et al [1969] 25 p refs Transl. into GERMAN from Russian report
(KFK-tr-308) Avail: AEC Depository Libraries

The statistical properties of the estimations of the strength functions are derived, and the distribution of the difference of the strength function for two spin states is determined theoretically. The theoretical results are compared with experimental data from the literature. The results showed that the difference in the strength functions does not occur in all nuclei but only in individual mass number areas. Where the strength functions vary strongly with A, the characteristics of the differences are difficult to determine within the framework of the analysis made, especially as there are no theoretical assumptions on the sign and magnitude of the effect to be expected. There is no basis for the assumption of an essential and common dependence of the strength function on the spin. NSA

N70-37263# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
ALPHA DECAY OF Rn 211 AND Rn 212
V. P. Afanasev, M. Bochvarova, N. A. Goloykov, I. I. Gromova, R. B. Ivanov et al 1970 11 p refs In RUSSIAN
(JINR-P6-4972) Avail: AEC Depository Libraries

The alpha-decay of Rn-211 and Rn-212 was investigated using the magnetic spectrograph. Besides the known alpha-transitions of Rn-211 (5850 keV (1), 5783 keV (1.84), 5616 keV (0.08) there were observed the new ones 5466 keV (4.1 • 0.0001), 5276 keV (4.4•0.0001), 5179 keV (8•0.00001) 5055 keV (2•0.00001). The hindrance factors are presented. New levels: 391.4 keV, 585 keV, 884 keV are introduced for the Po-207 nucleus. For Rn-212 the 5588 keV (5•0.0001) alpha-transition to the 687 keV level of PO-208 was observed. The parts of alpha-decay of At-211, Rn-211 and Po-207 (41.3 + or – 1.3%, 17.8 + or – 1.3% and 0.028 + or – 0.003%) are estimated. Author (NSA)

N70-37264# Deutsches Elektronen-Sychrotron, Hamburg (West Germany).
DETERMINATION OF STRONG INTERACTION NUCLEAR RADII
H. Alvensleben, U. Becker, William K. Bertram et al Feb. 1970 10 p refs Prepared in cooperation with MIT
(DESY-70/6) Avail: AEC Depository Libraries

Results are presented on the determination of a set of strong interaction nuclear radii using the photoproduction of neutral rho mesons. Analysis of 1000000 events from 13 complex nuclei yields the Woods–Saxon radii R(A) = (1.12 + or – 0.02) A(1/3)fm. Author (NSA)

N70-37265# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
VENEZIANO MODEL FOR THE OFF-MASS-SHELL R SUB 1 PION YIELDS PION PION AMPLITUDE
F. Csikor 1970 29 p refs
(JINR-E4-4959) Avail: AEC Depository Libraries

A Veneziano-type model for the off-mass-shell A sub 1 pion yields pion pion amplitude is obtained. At the same time any two of the masses are allowed to be off-shell. The model has all the expected good properties of off-shell Veneziano amplitudes, notably it has only the required poles in all the variables, satisfies the PCAC equation exactly, and is compatible with current algebra. Author (NSA)

N70-37280 European Organization for Nuclear Research, Geneva (Switzerland). Nuclear Physics Div.
HIGH-PRECISION GEOMETRICAL AND KINEMATICAL ANALYSIS OF MAGNET SPARK CHAMBER EVENTS
P. Mushlemann and J. D. Wilson 5 Jun. 1970 36 p refs
(CERN-70-17) Copyright. Avail: Issuing Activity

Until recently, the magnet spark chamber was mainly used for the detection of neutral particles decaying inside the sensitive volume. For a new series of experiments to study diffraction dissociation in reactions on a nucleus A and at energies from 9 to 16 GeV, the classical approximation of a circular helix was too crude. In order to obtain an efficient trigger and full exploitation of the optical spark chamber in the quasi-homogeneous part of the magnetic field, the target was positioned far out in the fringe field of the magnet. This meant tracking the particle back from the first measured point in the spark chamber over a distance of 55 to 65 cm into the target region. It was thus necessary to have: (1) a high precision geometrical fit of the particle paths inside the spark chamber, (2) an accurate extrapolation in the fringe field region, and (3) a reasonable vertex fit to the extrapolated tracks. To cope with these requirements, the geometrical reconstruction was based on a bubble chamber program fitting the track in a one component variable magnetic field. Author

N70-37283# Uppsala Univ. (Sweden). Inst. of Physics.
PERTURBATIONS OF THE ALPHA-GAMMA ANGULAR CORRELATION IN THE DECAY OF Ra 226
B. Orre, A. Linnfors, F. Falk, J. E. Thun, and L. Johansson Dec. 1969 40 p refs
(UUIA-660) Avail: AEC Depository Libraries

The gyromagnetic ratio for the first excited rotational state of Rn-222 was obtained by the technique of perturbed (alpha–gamma) angular correlations. The average internal magnetic field of radon atoms recoiling into nickel was determined to be 15 + or – 3 kilogauss and positive. The perturbations in different environments were studied by observing the coincidence rate in 180 deg between alpha and gamma. In vacuum the perturbations were severe but could be decoupled in a parallel magnetic field. A number of solids were examined and the perturbations were in general small. In all measurements thin sources were used. The thickness of one typical source was deduced from the energy loss of alpha particles. Author (NSA)

N70-37288# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
COMPILATION OF POTENTIAL ENERGY CURVES [RECUEIL DE COURBES D'ENERGIE POTENTIELLE]
Michel Schmidt Mar. 1970 72 p refs Partly in ENGLISH and partly in FRENCH
(CEA-BIB-176) Avail: CFSTI

The potential energy curves of diatomic molecules and molecular ions were collected. Certain curves had been obtained experimentally whilst others had been calculated. They each have an ordinate scale in electron-volts and an abscisse scale in Angstroms. Author (ESRO)

N70-37292# Lund Univ. (Sweden). Dept. of Physics.
AN ANALYSES OF STOPPING PARTICLES IN A BUBBLE CHAMBER, PART 1
G. von Dardel and G. Malmenryd Nov. 1969 65 p refs
(LUSY-6904) Avail: AEC Depository Libraries

A computer program, GUIDE, for analyzing stopping particle tracks in a magnetic field in a liquid hydrogen bubble chamber is presented. A general test of the program is presented in the form of the calculation of the mass of a K(+) stopping particle. Figures and the program listing are presented in LUSY-6905. NSA

N70-37294# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.
REMARKS ON THE BROKEN NONLINEAR CHIRAL U(3) x U(3) DYNAMICS OF HADRONS
V. I. Sabo and Yu. M. Lomsadze 1970 14 p refs Presented at the Inst. for Theoret. Phys. Seminar, Kiev
(ITF-70-20) Avail: CFSTI

In contrast to previous work the broken nonlinear chiral U(3) × U(3) dynamics of strong, electromagnetic and weak interactions of hadrons is considered in the most general form. Such a general consideration reduces the number of predictions only but does not change them. Author (NSA)

N70-37295# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.
PHOTOPRODUCTION OF THE NEUTRAL PSEUDOSCALAR MESONS ON NUCLEONS
N. A. Kobylinskii 1970 15 p refs In RUSSIAN; ENGLISH summary Presented at the Inst. for Theoret. Phys., Seminar Kiev
(ITF-70-10) Avail: AEC Depository Libraries

Within the framework of a model taking into account the contributions of rho meson and omega meson Regge poles and of rho meson P and omega meson P cuts, the processes of photoproduction of pion(0), eta and X mesons on protons and neutrons were considered. A number of relations between differential cross sections of the meson production by the polarized and unpolarized photons, asymmetries in the angular distribution of mesons and polarizations of the recoil nucleons were obtained. Author (NSA)

N70-37296# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.
ON THE HAMILTONIAN FORMULATION OF THE QUANTUM ELECTRODYNAMICS WITH GAUGE-NONINVARIANT REGULARIZATION
V. P. Pavlov and A. D. Suhanov 1970 9 p refs In RUSSIAN; ENGLISH summary Presented at the Conf. on High Energy Phys. and Theory of Elementary Particles, Kiev, Oct. 1969
(ITF-70-16; Conf-691035-8) Avail: AEC Depository Libraries

The interaction Hamiltonian in the interaction representation is constructed for quantum electrodynamics within the second order in charge in the gauge-noninvariant regularization case, when one needs to take into account the photon mass renormalization counter-term. It is shown, that one may not confine oneself to Wick theorem with only pair concentrations of the spinor fields in this case. There is an additional noncovariant term in the Hamiltonian, which corresponds to the difference between the Wick and Dyson tau-products of electromagnetic currents; this difference does not vanish under gauge-noninvariant regularization. Author (NSA)

N70-37299# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
THEORY OF REFLECTION OF PARTICLES ABOVE BARRIER ENERGIES
V. V. Babikov 1969 9 p refs In RUSSIAN
(JINR-P4-4567) Avail: AEC Depository Libraries

The problem of reflection of particles in a quasi-classical h approaching 0 limit is considered by the phase function method for energies above the barrier. Author (NSA)

N70-37301# Oak Ridge National Lab., Tenn. Neutron Physics Div.
A UNIFIED MODEL OF DEFORMED ODD-ODD NUCLEI FOR NUCLEAR DATA GENERATION AND ANALYSIS
C. Y. Fu (Ph.D. Thesis—Tenn. Univ.) and K. Y. Yost 20 Jan. 1970 54 p refs Submitted for publication
(PB-189694; ORNL-TM-2832) Avail: CFSTI CSCL 20H

A unified model of deformed odd-odd nuclei has been formulated as an aid in nuclear data generation and evaluation. The model employs products of single-particle Nilsson wave functions as basis functions. The coupling of angular momenta of the odd nucleons is assumed to obey the Gallagher-Moszkowski coupling rules. The matrix elements of the proton-neutron residual interaction potential are evaluated with the use of oscillator brackets. The validity of the model has been established by computing and comparing with experimental data nuclear energy levels and/or gamma-ray transition Na-23, Al-28, Ho-166, Ta-182, and Np-238. Special attention has been given to the establishment of an efficient computational method. Author (USGRDR)

N70-37302 Kernforschungszentrum, Karlsruhe (West Germany). Zyklotron Laboratorium.
PRODUCTION Be 7, Na 22, Na 24, AND Mg 28 BY IRRADIATION OF Al 27 WITH 52 MeV DEUTERONS AND 104 MeV ALPHA PARTICLES
U. Martens and G. W. Schweimer Nov. 1969 18 p refs
(KFK-1083) Avail: AEC Depository Libraries

Excitation functions for the production of Be-7, Na-22, Na-24 and Mg-28 by irradiation of Al-27 with deuterons and alpha particles were measured for the energy range available with the Karlsruhe Isochronous Cyclotron. The error in the absolute cross section scale is estimated to be 2.5%. The error in the energy scale is about 1 MeV in the threshold region and 0.5 MeV at the maximum energy. Author (NSA)

N70-37304# United Kingdom Atomic Energy Authority, Harwell (England).
THE ABSOLUTE STANDARDIZATION OF BARIUM 133
R. E. A. Paske Jan. 1970 15 p refs
(AERE-R-5341) Avail: AEC Depository Libraries; HMSO 2s. 6d.; BIS $0.50

An X-gamma coincidence method for the standardization of Ba-133 is described. The method involves coincidence counting between K- or L- X-rays and a selection of the coincident gamma rays. A correction factor to the normal coincidence equations is derived from the calculated probabilities of the occurrence of a single X-ray and a subsequent X-gamma coincidence. Second order corrections are avoided in the experimental arrangement by the use of low geometry X-ray counting. The dependence of the results on possible variations in the decay scheme is evaluated. A comparison

of results obtained using scintillation counters as X-ray and gamma-ray detectors with those obtained using a solid state gamma-ray detector showed good agreement. The latter approach simplifies data interpretation since a single gamma-ray energy may be selected. Author (NSA)

N70-37307# Los Alamos Scientific Lab., N.Mex.
THICK TARGET BREMSSTRAHLUNG THEORY
C. Robert Emigh 31 Mar. 1970 72 p refs
(Contract W-7405-eng-36)
(LA-4097) Avail: CFSTI

The calculations for thick target bremsstrahlung in the forward direction are presented. The theory presented is complete with regard to such details as multiple electron scattering, electron-energy degradation in the target, bremsstrahlung angular distribution, variation of bremsstrahlung distribution with a decreasing electron energy, and target self-absorption. Past theories have accounted for some, but not all, of these effects. The approximations presented are for heavy elements, particularly tungsten; they should also apply to the lighter elements but perhaps not with the same degree of accuracy. For the off-axis theory the same details are covered as for the on-axis theory. The angular displacement of the detector from the axis is accounted for. The off-axis is useful in determining the optimum target-object distance for certain densitometric or radiographic observations. Author (NSA)

N70-37313# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
PERTURBATION THEORY WITH THE CUT-OFF
D. I. Blokhintsev and G. I. Kolerov 1970 14 p refs In RUSSIAN Presented at the 2d Intern. Conf. on Non-Localized Quantum Field Theory, Azau, 1970
(JINR-P2-4952) Avail: AEC Depository Libraries

Perturbation theory with cut-off is considered. An algorithm of successive approximations is constructed so that fulfillment of the macroscopic casuality condition and that of the scattering S-matrix unitarity is provided. Author (NSA)

N70-37324# General Electric Co., Schenectady, N.Y. Knolls Atomic Power Lab.
INTERFERENCE EFFECTS IN THE CROSS SECTION FOR THE RADIATIVE CAPTURE OF A NEUTRON BY A Sm 149 NUCLEUS
I. V. Kirlpichnikov et al Feb. 1970 12 p refs Transl. into ENGLISH from Russian report JINR-P15-4325, 1969 Sponsored by AEC
(KAPL-Trans-1; JINR-P15-4325) Avail: CFSTI

The cross sections of the radiative neutron capture with excitation of the Sm-150 nucleus levels E = 5.53 and 7.21 MeV were measured using a Ge(Li) detector in the neutron energy interval from 0.12 to 1.5 eV. For explaining the observed energy dependences of the cross section, it is necessary to assume the existence of positive (constructive) interference between the first two resonance levels in the cross section. Author (NSA)

N70-37330# Scientific Translation Service, Ann Arbor, Mich.
CASCADE MODEL OF PHOTONUCLEAR REACTIONS
K. K. Gudima et al [1970] 11 p refs Transl. into ENGLISH from Russian Report JINR-P2-4661, 1969 Sponsored by AEC Prepared for ORNL
(ORNL-tr-2267; JINR-P2-4661) Avail: CFSTI

The intranuclear cascade model, used previously for investigation of pion- and nucleon-nucleus collisions, is applied in studying inelastic interactions of high energy gamma-quanta with atomic nuclei. The results are in good agreement with the available experimental data. Author (NSA)

N70-37331# Brookhaven National Lab., Upton, N.Y.
STABILIZING SHELL EFFECTS IN EXCITED NUCLEAR LEVELS AND STRUCTURE PARAMETERS OF THE NEUTRON STRENGTH FUNCTION
S. I. Sukhoruchkin Feb. 1970 21 p refs Transl. into ENGLISH from Yadern. Fiz. (USSR), v. 10, 1969 p 251–261 Sponsored by AEC
(BNL-tr-333) Avail: CFSTI

Analysis of the experimental data on the excited-level positions of a broad range of nuclei confirms in stabilizing effect (found earlier) with the range of several tens of keV. The pairing effect in the single-particle level positions has a range about 1 MeV. Groupings in the values of the neutron separation energies and the neutron level positions of light nuclei can be expressed by the superposition of these two intervals (30 keV and 1.02 MeV). To obtain reliable values of strength functions when averaging the neutron widths of individidual resonances it is necessary to fulfill the condition that the averaging interval exceed the characteristic energy period (30 keV). Author (NSA)

N70-37332# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
A MICROSCOPIC MODEL FOR INELASTIC SCATTERING OF LOW AND MEDIUM ENERGY PROTONS [UN MODELE MICROSCOPIQUE POUR LA DIFFUSION INELASTIQUE DE PROTONS A BASSE ET MOYENNE ENERGIE]
Richard Schaeffer (Ph.D. Thesis – Paris Univ., 25 Jun. 1969) May 1970 146 p refs In FRENCH; ENGLISH summary
(CEA-R-4000) Avail: CFSTI

The microscopic description of inelastic proton scattering is usually made in the DWBA approximation using an effective two-body force which acts between the incident nucleon and the excited particle in the target and is fitted to the experimental data. Such an approach however leads to poor angular distributions, except when using rather short range forces, and the effective strength has a tendency to increase for large spin transfer and to depend on energy. In this report the exchange effects arising from the antisymmetrization of the incident particle, target wave functions, and from the exchange nature of the nuclear forces are taken into account. This model predicts the experimental magnitude of the cross sections without any adjustable parameter for inelastic scattering when the bound state description is good. In particular, it explains the spin and energy dependence of the experimental cross-section strengths. Some very simple models are developed in order to discuss the physical features of the pp' excitations. The mechanisms by which the inelastic scattering occurs are demonstrated and the sensitivity of the results to only a few nucleon-nucleon parameters is explained. The model was also used as a spectroscopic tool for nuclei with one open shell. Author (ESRO)

N70-37345# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
SINGLET STATES IN DEFORMED NUCLEI. DIPOLE SUM RULE AND STRENGTH FUNCTION FOR M1 TRANSITIONS
S. I. Gabrakov, A. A. Kuliev, and N. I. Pyatov 1970 14 p refs
(JINR-E4-4908) Avail: AEC Depository Libraries

The properties of 1(+) excitations and the role of spin-spin interaction in formation of a magnetic dipole resonance resonance in even rare earth nuclei are investigated. It is shown that the spin-spin interaction decreases the average reduced width for M1 transitions for the low-lying 1(+) states and concentrates a large part of M1 strength in the region of energy of 10 to 13 MeV. M1 resonance is formed mainly by transitions between discrete levels belonging to the spherical spin-orbital partners and is considered as a quasi-stationary state in the continuous spectrum. Author (NSA)

N70-37348# Argonne National Lab., Ill.
GASOUT: THE CODE USED TO CALCUALTE GASEOUS FISSION PRODUCT RELEASE FOR A ZPR-6 AND ZPR-9 DESIGN BASIS ACCIDENT
C. D. Swanson and E. M. Bohn Jan. 1970 48 p refs
(Contract W-31-109-eng-38)
(ANL-7534) Avail: CFSTI

Program GASOUT calcualtes the amount of noble gas and radioiodine fission products expelled into the atmosphere following a ZPR-6 and -9 design basis accident. Tabulated values of fission product activities following fission are combined with a calculation of time-dependent cell pressure to determine the number of fission product atoms released. This information can then be used to determine the radiological hazard to a man standing downwind from the reactor during the accident. The code is written for the IBM 360/50/75 computer. Author (NSA)

N70-37351# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation.
NUCLEON POLARIZATION IN THE REACTIONS NN YIELDS NN PION AT 669 MeV IN THE ONE-PION-EXCHANGE MODEL
L. S. Azhgirei and V. I. Chizhikov 1970 27 p refs In RUSSIAN
(JINR-P2-4937) Avail: AEC Depository Libraries

The calculations of the proton polarization in the reactions pp yields pion(+) and pp yields pion sup 0 at 669 MeV are performed within the framework of the one-pion-exchange model. It is shown that polarization is due, in general, to the interference of the resonance P sub 33-amplitude with nonresonant amplitudes of the virtual pion-N scattering. The value and the angular dependence of the polarization are very sensitive to the behavior of the pion -N scattering amplitudes off the mass shell and to the assumptions about the the nucleon form-factor. Experimental investigation of the secondary proton polarization in the reactions pp yields NN pion and the analysis of the data within the scope of the one-pion-exchange model can yield the information on the mechanism of a single pion production at 669 MeV. Author (NSA)

N70-37352# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
EIKONAL APPROXIMATION FOR THE INELASTIC SCATTERING AMPLITUDE IN QUANTUM FIELD THEORY MODEL
B. M. Barbashov, S. P. Kuleshov, V. N. Pervushin, and A. N. Sisakian 1970 12 p refs
(JINR-E2-4955) Avail: AEC Depository Libraries

Processes of scattering of two scalar nucleons with production of scalar mesons in the model L sub int = g: psi to the second power (x)phi(x): are considered. The case of single particle production is investigated in detail. It is shown that it is possible to represent the inelastic scattering amplitude in terms of the eikonal elastic amplitude in a certain region of the momenta of the produced particle. Author (NSA)

N70-37353# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.
SPONTANEOUS FISSION OF THE ISOTOPES OF ELEMENTS 103 AND 105
G. N. Flerov, Yu. Ts. Organesyan, Uu. V. Lobanov, Uy. A. Lazerev and S. P. Tretyakova 1970 9 p refs In RUSSIAN
(JINR-P7-4932) Avail: AEC Depository Libraries
Avail: AEC Depository Libraries

Production of spontaneously fissionable nuclei in bombarding Am-243 with O-18 and Ne-22 ions (with the energies 95 and 119 MeV, respectively) was investigated. It is shown that for 103 isotopes with the mass numbers 256 and 257 the period of spontaneous fission is more than 100,000 s. In the reaction Am-243 + Ne-22 an emitter of the spontaneous fission fragments with the half-life of about 2s was observed; its yield corresponds to the corss section 10 to the minus 34th power sq cm. Special check experiments as well as the analysis of other possible reactions allow one to assume that the spontaneous fission of element 106 produced in the reaction Am-243(Ne-11, xn) element 105-265-X was observed. Author (NSA)

N70-37354# Institute of Nuclear Research, Warsaw (Poland).
EMISSION OF HYDROGEN AND HELIUM ISOTOPES IN THE FISSION OF PU-234; CLASSICAL MODEL OF THE TERNARY FISSION
Tadeusz Krogulski 1969 133 p refs
(INR-1142) Avail: AEC Depository Libraries

The fission of Pu-239 nuclei is accompanied by the emission of three hydrogen isotopes protons, deuterons and tritons, and three helium isotopes, He-4, He-6, and He-8. The distributions were fitted to the measured spectra and the relative yields were calculated from the distribution extrapolated. The comparison with analogous data on the spontaneous fission of Cf-252 and thermal neutron fission of U-235 reveals a pronounced similarity of the tripartition process irrespective of the nucleus involved. An analysis based on results is undertaken to establish the extent to which it is possible to infer in a sufficiently univocal way, from the observed energy and angular distributions of hydorgen and helium isotopes, the scission configuration of the uncleus undergoing fission. The configuration chosen is in agreement with the predictions of liquid drop model. This result is discussed in terms of the predictions of the microscopic model regarding the saddle point deformation. Author (NSA)

N70-37358# Institute of Nuclear Research, Warsaw (Poland).
MODEL CALCULATIONS OF THE ENERGY AND ANGULAR DISTRIBUTIONS OF LIGHT NUCLEI ACCOMPANYING FISSION
T. Krogulski and J. Blocki 1969 23 p refs
(INR-P-1138) Avail: AEC Depository Libraries

The known energy and angular distributions of light nuclei accompanying fission of heavy nuclei are transformed to the initial conditions of three-body motion treated classically, i.e., in terms of the Coulomb interaction. It is assumed that these initial conditions are closely related to the scissioning configuration of the nucleus. Hence, some conclusions concerning the latter and a comparison with the predictions of the liquid drop model are presented. Author (NSA)

N70-37385# Roanoke Coll., Salem, Va. Dept. of Physics.
PROTON SPUTTERING Annual Progress Report, 1 Jun. 1969 - 28 Feb. 1970
Charles R. Finfgeld Mar. 1970 7 p refs
(Contract AT(40-1)-3557)
(ORO-3557-10; ARP-4) Avail: CFSTI

The results of a study of wall erosion in controlled thermonuclear fusion devices are briefly summarized. Experiments on the sputtering isotope effect, using He(+) ions on ruthenium, are described; results are inconclusive. An experiment on electron sputtering of beryllium is in progress. NSA

N70-37393*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SEMIEMPIRICAL ELECTRIC DIPOLE MOMENT AND ITS DERIVATIVE H2-H2 and H2-H COLLISIONS
R. W. Patch Washington Sept. 1970 52 p refs
(NASA-TN-D-5994; E-5581) Avail: CFSTI CSCL 20H

The dipole moment and its derivative with respect to H2 internuclear distance were calculated for intermolecular distances

of 4 to 8 bohr by using a semiempirical model H2-H2 previously developed by others. In this model the dipole moment and its derivative are the sum of an overlap contribution and a quadrupole-induced contribution. For H2-H2 both contributions were improved. For H2-H they were reformulated. For H2-H2 four planar configurations and one nonplanar configuration were used and substantial agreement with infrared absorption was obtained. For H2-H three configurations were used. The ultimate application of the results is in calculating pressure-induced infrared absorption of hydrogen gas. Author

N70-37400# Lund Univ. (Sweden). Dept. of Physics
AN ANALYSIS OF STOPPING PARTICLES IN A BUBBLE CHAMBER, PART 2
G. von Dardel and G. Malmenryd Nov. 1969 40 p
(LUSY-6905-Pt-2) Avail: AEC Depository Libraries

Figures and the program listing for GUIDE for analyzing stopping particle tracks in a magnetic field in a liquid hydrogen bubble chamber are presented. Development of the program is described in LUSY-6904. NSA

N70-37404# Akademiya Nauk URSR, Kiev. Inst. Theoreticheskoi Fiziki.
LOCAL SELF-CONSISTENT FIELD IN NUCLEI WITH A GREAT NUMBER OF NUCLEONS
G. F. Filippov and I. V. Simenog 1969 10 p refs Presented at the Inst. for Theoret. Phys. Seminar, Kiev
(ITF-69-64) Avail: AEC Depository Libraries

The equations for the local self-consistent field in nuclei with a large number of nucleons are derived. The field is necessary to build the best one-particle wave function for the fermion system. The equations are described as being a simpler approach to the problem than the Hartree – Fock method. NSA

N70-37413# Tokyo Univ. (Japan). Inst. for Nuclear Study.
PHOTOPRODUCTION OF KAON (+) FROM HYDROGEN BELOW 1.2 GeV
Seigi Iwata (Ph.D. Thesis) 13 Mar. 1970 82 p refs
(INSJ-115) Avail: AEC Depository Libraries

In order to study the resonant behavior of the positive kaon lambda degree state around a total energy of 1700 MeV, differential cross sections for the gamma + proton yields positive kaon + lambda degree were measured along with polarization of lambda degree -hyperons at c.m. angles aroud 45 deg, 70 deg, and 90 deg for each of the laboratory photon energies ranging from 1000 to 1170 MeV, resulting in 18 cross sections. At 1180 MeV, two differential cross sections were also obtained for the reaction gamma + proton yields positive kaon + sigma degree. Positive kaon -mesons were momentum analyzed with a sector magnet and successfully identified on the basis of their time-of-flights and energy losses. Copious pions were rejected to two Lucite Cerenkov counters of total reflection type. The data were taken on line with a small computer and stored on microtapes for the off-line analysis. The differential cross sections were fitted well with only s- and p-waves as already seen in the existing data, indicating no hint of the resonant behavior of a particular partial wave. Author (NSA)

N70-37436# Ludwig-Maximilians-Universitat, Munich (West Germany).
THE PRODUCTION OF MUON (+) MUON(-) PAIRS IN HIGH-ENERGY PION(-) PROTON [DIE ERZEUGUNG VON MUON(+) MUNO(-) PAAREN IN HOCHENERGETISCHEN PION (-) PROTON WECHSEL WIRKUNGEN]
Peter Weilhammer (Ph.D. Thesis) Dec. 1969 130 p refs In GERMAN
(NP-18205) Avail: AEC Depository Libraries

At the CERN proton synchrotron accelerator the production of mu pairs was studied after (negative pion) interactions. The mean momentum of pi mesons at the target was 11.1 GeV/c. Pair formation was determined by means of a spark chamber with two magnetic spectrometers and a system of scintillation counters. Recorded events were evaluated from films and fed into a computer for further analysis. Quantitative analysis was limited to the special reaction pion-p yields muon(+) muon(-)n. Cross sections for the muon(+) muon (-) pair decays of rho, omego, phi, and eta were determined for the vector mesons. NASA

N70-37442# Akademiya Nauk URSR, Kiev. Inst. Teoretischeskoi Fiziki.
THE RIEMANN METHOD IN THE INVERSE PROBLEM OF SCATTERING THEORY, PART 1
E. I. Gugushvili and Yu. L. Mentkovskii 1970 13 p refs Presented at the Inst. for Theoret. Phys. Seminar, Kiev
(ITF-70-6) Avail: AEC Depository Libraries

The main points of the rigorous substantiation of the previously suggested scheme of restoration of the nuclear potential which corresponds to given data of the nuclear-Coulomb scattering are considered. Author (NSA)

N70-37445# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.
LECTURES ON SCATTERING THEORY. PART 8
A. G. Sitenko 1970 54 p refs In RUSSIAN; ENGLISH summary
(ITF-70-8) Avail: AEC Depository Libraries

The bases of the nonrelativistic theory of potential scattering are presented. Scattering of particles with spins and polarization phenomena are considered. Author (NSA)

N70-37446# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.
LECTURES ON SCATTERING THEORY, PART 5
A. G. Sitenko 1970 26 p In RUSSIAN; ENGLISH summary
(ITF-70-7) Avail: AEC Depository Libraries

The bases of the nonrelativistic theory of potential scattering are presented. Bound state scattering in the three particle system is considered. Author (NSA)

N70-37448# Los Alamos Scientific Lab., N.Mex.
INVESTIGATION OF MASS AND TIME DISTRIBUTION OF DELAYED NEUTRONS IN THE THERMAL FISSION OF U 235 BY AN ON-LINE MASS SEPARATOR
E. Roeckl 23 Jan. 1970 40 p refs Transl. into ENGLISH from German Report Sponsored by AEC Prepared by Kanner Associates
(LA-4176-tr) Avail: CFSTI

The delayed neutron emission in the thermal fission of U-235 was investigated with a helium-filled mass separator. The neutron activity was measured in coincidence with the beta decay arising from neutron emission. From the measurement of the activity buildup, the neutron yield for various times after fission was determined, and the half-life was obtained from the measurement of the activity decay. The mass distribution of these magnitudes was determined in the total fission yield range. The total neutron yield of light fission products is 1.05 neutrons/100 fissions. The measured mass and time dependence were compared with the previously published values for identified neutron emitters. Previously unidentified fractions of the activity in the mass range from 85 to 88 (half-life of 1 sec) and the mass range from 96 to 100 (half-life of 1.5 sec) are discussed. Author (NSA)

N70-37449# Los Alamos Scientific Lab., N.Mex.
IDENTIFICATION AND NUCLEAR SPECTROSCOPY OF SEVERAL SHORT-LIVED FISSION PRODUCTS WITH AN ON-LINE MASS SEPARATOR

J. Eidens (Ph.D. Thesis) 23 Mar. 1970 42 p refs Transl. into ENGLISH from German report NP-17528 Sponsored by AEC
Prepared by Kanner Associates
(LA-4174-tr; NP-17528) Avail: CFSTI

At the focus of the helium-filled mass separator for fission products at the Juelich-2 research reactor, an apparatus for nuclear spectroscopy on short-lived fission products was constructed. A mass calibration of the separator was carried out by the use of the gamma radiation of known long-lived fission product the unknown short-lived fission products, the half-life of the decay was determined on the basis of some very intense gamma lines. The lines found were assigned to 8 nuclides, for which half-lives and Q-values of the beta decay were measured. In three cases the decay curves obtained permit estimation for the half-lives of the mother nuclides.
Author (NSA)

N70-37458*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ELECTRON PARAMAGNETIC RESONANCE OF V(2+), Mn(2+), Fe(3+) AND OPTICAL SPECTRA OF V(3+) IN ZOISITE Ca2Al3Si3O12(OH)
Tung Tsang and Subrata Ghose Aug. 1970 28 p refs
(NASA-TM-X-65320; X-644-70-319) Avail: CFSTI CSCL 20H

Electron paramagnetic resonance and optical absorption spectra were used to clarify the local environments of transition metal ions and their distributions among various Al- and Ca-sites in a gem quality zoisite crystal from Tanzania. The EPR spectra due to Mn2(+), Fe3(+) and two types of V2(+) were interpreted by the spin Hamiltonian.
Author

N70-37470*# National Bureau of Standards, Washington, D.C.
REVIEW AND UPDATING OF INFORMATION ON TRANSMISSION AND REFLECTION OF ELECTRONS BY ALUMINUM SHIELDS
4 Aug. 1970 53 p refs
(NASA Order R-80)
(NASA-CR-112838) Avail: CFSTI CSCL 20H

The available information regarding the transmission and reflection of high-energy electrons by aluminum shields is reviewed. The incident electron energies considered lie between 0.5 MeV and 10.0 MeV; covering the region of interest for shielding against electrons in natural and artificial radiation belts. Emphasis is placed on summary parameters such as number and energy transmission coefficients, reflection coefficients, and practical ranges. Extensive new data are tabulated which were calculated with the Monte Carlo computer program ETRAN 16. Numerous comparisons are also made with all pertinent experiments in order to review the experimental situation and to verify the validity of the method of calculation.
Author

N70-37475# Lyon Univ. (France). Inst. de Physique Nucleaire.
ON THE ELEMENTARY PARTICLE TREATMENT OF MUON CAPTURE AND RADIATIVE PION CAPTURE IN LITHIUM 6
J. Delorme 16 Feb. 1970 21 p refs
(LYCEN-7005) Avail: AEC Depository Libraries

The elementary particle approach to muon capture and radiative pion capture in nuclei is discussed for the particular case of the transition between the ground states of Li-6 and He-6. Its validity is proved by comparison with standard calculations in the impulse approximation. The calculated capture rates are found to be consistent with the experimental data in contradistinction to previous estimates.
NSA

N70-37477# Stanford Linear Accelerator Center, Calif.
VECTOR DOMINANCE MODEL INVESTIGATION AT SLAC
Zaven G. T. Guiragossian Dec. 1969 106 p refs Presented at Intern. Seminar on Vector Mesons and Electromagnetic Interactions, Dubna, USSR, 23–26 Sep. 1969 Supported in part by AEC
(PB-189037; SLAC-Pub-694) Avail: CFSTI CSCL 20H

The discussed experimental results can be divided in the following topics: (1) total cross section of (gamma-p) and the forward vector meson photoproduction cross sections; (2) vector meson photoproduction by linearly polarized photons; (3) single pion photoproduction in the t- and u-channels and negative pion proton yields neutral rho meson neutron; (4) t-channal delta-photoproduction and positive pion proton yields neutral rho meson doubly positive delta; (5) A-dependence of total cross section of (gamma-A) and cross section of (gamma A yields pion A); and (6) ep inelastic scattering processes.
USGRDR

N70-37480# Oak Ridge National Lab., Tenn.
CALCULATION OF THE ENERGY DEPOSITED IN THICK TARGETS BY HIGH-ENERGY (1 GeV) ELECTRON-PHOTON CASCADES AND COMPARISON WITH EXPERIMENT, 2
R. G. Alsmiller, Jr. and H. S. Moran 15 Jan. 1970 7 p refs Submitted for publication Supported in part by AEC
(PB-189102; ORNL-TM-2843) Avail: CFSTI CSCL 20H

Electron-photon cascade calculations have been carried out for a zero-width beam of 1 GeV electrons normally incident on semi-infinite slabs of water and aluminum. The calculated results presented here differ from those given in a previous paper in that the density-effect correction to the stopping power of matter for electrons has been taken into account. The calculated results are compared with experimental data, and it is shown that the agreement between calculated and experimental energy-deposition data is improved considerably when the density effect correction is included in the calculations.
Author (USGRDR)

N70-37497# Comitato Nazionale per L'Energia Nucleare, Frascati (Italy) Lab. Nazionali.
TEST OF VECTOR MESON DOMINANCE MODEL IN THE COLLIDING BEAM REACTION e(+) and e(-) YIELDS P AND gamma
E. Etim and P. Picchi (CNR, Turin) 27 Oct. 1969 11 p refs *Its* Nota Interna No. 454
(LNF-69/64) Avail: AEC Depository Libraries

The commutation rules of gauge field and quark field algebra are used to derive sum rules for the electromagnetic form factors of the decays (P is identical with neutral pion, eta meson, neutral X) yields gamma plus gamma, gamma, making use of the Bjorken limit theorem. Assuming that these sum rules can be saturated by vector meson poles and that the resultant form factors correctly describe the processes positron plus electron yields P plus gamma, P yields positron plus electron plus gamma, P yields gamma plus gamma in their appropriate kinematical regions, it is found that the prediction of gauge field algebra (field current identity) but not that of uqark field algebra is in conflict with experiment in the reaction positron plus electron yields neutral pion plus gamma. It is also shown that field current identity fails to predict correctly the width Gamma(neutral pion yields 2 gamma).
Author (NSA)

N70-37513# Tubingen Univ. (West Germany). Inst. fuer Theoretische Physik.
STUDIES IN THE CLUSTER MODEL OF THE ATOMIC NUCLEUS BY METHODS OF GROUP THEORY [GRUPPENTHEORETISCHE UNTERSUCHUNGEN ZUM CLUSTERMODELL DER ATOMKERNE]
T. H. Seligman Dec. 1969 94 p In GERMAN; ENGLISH summary
(BMBW-FBK-69-42) Avail: AEC Depository Libraries

The group-theoretical properties of the nuclear cluster model are investigated. The symmetric group proves to be especially

important. The consideration of permutational symmetry in the cluster ansatz shows that there is a close relation between this ansatz and the Wigner supermultiplet scheme. The antimetrization is simplified in a systematic way. The coefficients appearing in the procedure are calculated from the representations of the symmetric group. Author (NSA)

N70-37516# Melbourne Univ., Parkville (Australia).
THE THERMAL DISSOCIATION OF HAFNIUM TETRAIODIDE [BEITRAG ZUR THERMISCHEN DISSOZIATION VON HAFNIUMTETRAJODID]
J. Gerlach et al 1968 10 p refs Transl. into ENGLISH from J. Less-Common Metals (Amsterdam), v. 15, 1968 p 303–310
(NP-tr-1888) Avail: AEC Depository Libraries

The transport rate of hafnium was measured as a function of the temperature of the crude metal, the deposition temperature, and the HfI4 vapor pressure. A maximum was obtained for a hafnium iodide vapor pressure of 0.7 torr. It was concluded from the investigation that below a total pressure of 0.35 torr, the reactions at the deposition wire were rate-determining, whereas the rate was determined by gas diffusion at higher pressures. The typical appearance of a maximum in the transport rate was, however, determined by thermochemical equilibrium conditions at the deposition wire. Author (NSA)

N70-37523# Helsinki Univ. (Finland). Dept. of Physics.
A 31 ms ISOMERIC ACTIVITY IN Gd 155
E. Liukkonen, V. Pursiheimo, and T. Tuurnala Jan. 1969 12 p refs
(NP-18191) Avail: AEC Depository Libraries

A 31 + or – 2 ms isomeric activity which is assigned to Gd-155 was produced through the reaction Gd-156(n,2n)Gd-155 with 14–15 MeV neutrons. The 31 ms activity contains Gd K X-rays and an 86.5 keV E1-transition, which corresponds to a well-known E1-transition depopulating the 86.5 keV level in Gd-155. Most probable candidates for the isomeric state in Gd-155 lie at 105 keV (9/2+) and at 118 keV (11/2–). Author (NSA)

N70-37525# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Lab. Nazionali.
UNITARITY AND VENEZIANO-LIKE PION FORM FACTOR
F. Drago and A. F. Grillo 3 Oct. 1969 13 p refs *Its* Nota Interna No. 452
(Contract F61052-67-C-0084)
(LNF-69/58) Avail: AEC Depository Libraries

A unitarization method is studied in connection with the recently proposed Veneziano-like models for the pion electromagnetic form factor. Using as input the model proposed by Suura, good agreement is obtained with the experimental data in the time-like region. Author (NSA)

N70-37548*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ELECTRON TRANSPORT FROM A COSINE LAW SOURCE
Charles E. Wuller, Jr. 16 Sep. 1969 17 p refs
(NASA-TM-X-53912; MSFC-IN-SSL-N-68-13) Avail: CFSTI CSCL 20H

A technique is presented for calculating the electron transport and dose expected behind aluminum shields. Results are included for a source whose angular distribution of flux incident on a shield follows the cosine function. A comparison is given of the dose expected from a cosine law source to doses from sources for isotropic and normal angular distribution. Author

N70-37584*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A BRIEF DISCUSSION OF BERGER'S LATEST MONTE CARLO PROGRAM
J. H. Derrickson 16 Sep. 1969 14 p refs
(NASA-TM-X-53915; MSFC-SSL-P-68-12) Avail: CFSTI CSCL 20H

The Monte Carlo program furnishes the user with a battery of information associated with the transport of electrons and photons through matter. Stochastic processes are used in arriving at the theoretical results. The data are compared with the latest experimental data of D. H. Rester. Author

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N70-36241# Miami Univ., Coral Gables, Fla. Plasma Physics Lab.
DYNAMIC STABILITY OF CLOSED PLASMA CONFIGURATIONS
Daniel R. Wells 1 Feb. 1970 48 p refs Revised
(Grant AF-AFOSR-844-67)
(AD-704621; MIAPH-PP-70-2; AFOSR-70-1017TR) Avail: CFSTI CSCL 20/9

The global stability of closed plasma configurations is related to the dynamical principle of least constraint and the space-time and gauge symmetries of the flow fields. This leads to an entirely new concept of MHD stability which is more basic than stability predictions which rely on a linearized perturbation analysis. The predictions of the theory are compared to recent experimental results obtained in studies of the stability of plasma confinement geometries. The theory predicts the violent instabilities of these systems which are currently attributed to other mechanisms. Several pertinent details of the theory which are widely misinterpreted are discussed and clarified. Author (TAB)

N70-36254# Harry Diamond Labs., Washington, D.C.
COMPUTER SOLUTIONS OF WAVE PROPAGATION THROUGH NONUNIFORM PLASMA LAYERS
F. J. Tischer Oct. 1969 33 p refs
(AD-700993; HDL-TR-1467) Avail: CFSTI CSCL 20/9

Complex reflection and transmission coefficients are determined by computer for symmetrically nonuniform plasma layers. The electron densities vary within the layers according to 1 - x to the 8th power, 1 - x to the 4th power, and 1 - x squared for -1 < x < +1 at constant collision frequency. Infinite slabs and nonuniform layers in a waveguide are considered. Graphs of the complex reflection and transmission coefficients and of the changes caused by the nonuniformities are shown in terms of normalized plasma parameters. The method of computation, the computer program, and the diagrams are useful in plasma diagnostics and communications. In diagnostics, probing waves are transmitted through a nonuniform plasma layer between horn antennas or in a waveguide test section. In communications, waves are transmitted through plasma layers in front of a horn antenna. Author (TAB)

N70-36408# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INTERNATIONAL SYMPOSIUM ON MAGNETOHYDRODYNAMIC ELECTRICAL POWER
N. M. Maslennikov et al 22 Sep. 1969 31 p refs Transl. into ENGLISH from the Russian
(AD-703158; FTD-MT-24-150-69) Avail: CFSTI CSCL 10/2

Contents: Experimental investigation of electrical conductivity of a plasma on a model MHG generator; Spectroscopic investigation of an argon-cesium plasma. TAB

N70-36475# Aerospace Corp., El Segundo, Calif. Lab. Operations.
LOW-FREQUENCY INDUCTION PLASMAS, REPORT FOR JUNE 1968 – DECEMBER 1969
Hans U. Eckert 27 Feb. 1970 18 p refs
(Contract F04701-69-C-0066)
(AD-704586; TR-0066(9220-02)-7; SAMSO-TR-70-151) Avail: CFSTI CSCL 20/9

The possibility of generating thermal electrodeless plasmas at frequencies below the rf range through the use of magnetic materials is investigated analytically and experimentally. Existing minimum frequency and voltage criteria for the maintenance of quasi-steady, tube-filling a-c arcs are combined with the induction law to yield design criteria for a plasma transformer that has a conventional iron core and primary, but has the secondary replaced by a torus-shaped vessel that contains a single plasma turn. The feasibility of the idea is demonstrated on a small model with an iron core of 100 sq cm cross section at a frequency of 9600 Hz, generating 220 V per turn in the unloaded state. Steady discharges have been obtained in argon at pressures up to 500 Torr, in which case the plasma current at this pressure was 100 A and the maintenance voltage was 120 V. The estimated minimum dimensions for maintaining an atmospheric pressure argon plasma at 60 Hz are 30 cm for the core radius and 4 cm for the small radius of the torus. Author (TAB)

N70-36508# York Univ., Toronto (Ontario). Centre for Research in Experimental Space Science.
PLASMA SHEATH AROUND A FLOATING CYLINDRICAL ANTENNA AT HIGH POWER
J. Rubinstein and J. G. Laframboise [1969] 30 p refs
(Grants NRC A-4638; DRB-G-9510-84)
Avail: CFSTI

At high frequencies the time averaged effect of the radiation field near an antenna is to add a term to the Coulomb potential. Its inclusion in a self-consistent Poisson-Vlasov analysis shows that a high power antenna may acquire a strong positive floating potential. Electron, ion and potential profiles are obtained from numerical calculations, and the effect on antenna impedance is discussed. Time taken to acquire positive potentials is estimated. Author

N70-36525# Flordia Univ., Gainesville. Dept. of Nuclear Engineering Sciences.
DOUBLE-PROBES AND SCATTERING OF A LASER BEAM AS DIAGNOSTIC METHODS ON A PULSED HIGH-TEMPERATURE PLASMA, PART 5 Final Technical Report
Siegfried Metz 1 Jan. 1970 77 p refs
(Contract Nonr-580(19))
(AD-704822) Avail: CFSTI CSCL 20/9

Increasing particle density and temperature can be observed during the decay of a pulsed, electrodeless discharge. Responsible for this effect are electrostatic waves, excited by interactions of beams of charged particles with the decaying plasma. Under certain discharge conditions a convective instability occurs. Two diagnostic methods are employed to investigate this instationary high-temperature plasma. A double-probe technique based on sampling methods gives excellent time and spatially resolved results although this method is rather complicated and only seldom employed in case of high-voltage discharges. Maximum discharge voltage is restricted to 35 KV. Author (TAB)

N70-36566*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
KINETIC THEORY OF PLASMA IN A MAGNETIC FIELD
John C. Price Aug. 1970 24 p refs Submitted for publication
(NASA-TM-X-65308; X-641-70-317) Avail: CFSTI CSCL 20I

The Krylov-Bogoluibov transformation is used to simplify the guiding center equations for a charged particle in electric and magnetic fields. The resulting transformation of variables is then applied to the Vlasov distribution function, yielding a magnetic Vlasov equation which describes the low frequency behavior of a system with no statistical effects. The equation is generalized to include effects of high and low frequency fluctuations. A consistent treatment of the conservation laws and Maxwell's equations is given to complete the kinetic description. Author

N70-36773*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
ON THE RELATIONSHIP OF THE PLASMA SHEET, RING CURRENT, TRAPPING BOUNDARY AND PLASMAPAUSE NEAR THE MAGNETIC EQUATOR AND LOCAL MIDNIGHT Progress Report
L. A. Frank Jun. 1970 45 p refs
(Contract NAS5-2054; Grant NGL-16-001-002; Contract N00014-68-A-0196-0003)
(NASA-CR-112673; U-OF-IOWA-70-33) Avail: CFSTI CSCL 20I

Observations of the complex structure of the near-earth termination of the plasma sheet in the pre- and post-midnight sectors of the magnetosphere near the magnetic equator were obtained with a sensitive electrostatic analyzer array flown on the earth-satellite OGO 3 during June through July 1966. Principal observational results include: (1) The trapping boundary for energetic electrons at E greater than or equal to 40 keV is positioned within the extraterrestrial ring current and near its outer edge. (2) The inner boundary of the earthward edge of the plasma sheet is coincident with the plasma-pause position in the post-midnight sector and is located at 1 to 3 earth radii beyond the plasma-pause position in the pre-midnight sector. (3) An electron trough characterized by relatively low, constant electron energy densities lies between the plasmapause and the inner boundary of the earthward edge of the plasma sheet in the pre-midnight sector. (4) The plasmapause is located within the region of the extraterrestrial ring current. Author

N70-36946* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CONTINUOUSLY OPERATING INDUCTION PLASMA ACCELERATION Patent
Raymond L. Barger, Joseph D. Brooks, and William D. Beasley, inventors (to NASA) Issued 23 Mar. 1965 (Filed 24 Jan. 1963 8 p Cl. 60-35.5
(NASA-Case-XLA-01354; US-Patent-3,174,278; US-Patent-Appl-SN-253774) Avail: US Patent Office CSCL 20I

The plasma accelerator described uses a continuously operating induction principle capable of producing supersonic speeds. A source of high frequency is utilized to maintain a portion of the gas within the accelerator ionized. Magnetic lines linking the ionized gas are directed radially, thereby interacting with the current induced in the ionized gas to provide a force in the direction of plasma flow. Utilizing a single phased induction system, the accelerator has an ionized loop in the plasma to prevent its becoming nonconductive between the peaks of current induced by the driver coil. A highly permeable material is used within the accelerator to increase magnetic lines of flux, increasing the voltage induced in the gas and the degree of ionization. The current loop induced in the ionized gas is located close to the inducing means, but downstream from it. The device is operable over a wide pressure range. It may be used to accelerate a plasma, to operate as a low thrust plasma engine, and to pump an ionizable gas. P.A.B.

N70-37008# Princeton, N.J. Plasma Physics Lab.
ANOMALOUS HIGH-FREQUENCY RESISTIVITY AND HEATING OF A PLASMA
W. L. Kruer, P. K. Kaw, J. M. Dawson, and C. Oberman Mar.

1970 14 p refs
(Contracts AT(30-1)-1238; AF 49(638)-1555; N00014-67-A-0151-0021)
(MATT-756) Avail: CFSTI

Computer experiments were carried out on the anomalous heating of a one-dimensional plasma by a large-amplitude long-wavelength electric field oscillating near the plasma frequency. Above a certain threshold the large driver field excites an instability in the plasma and drives up ion-density fluctuations as well as plasma oscillations. When the ion fluctuations reach a sufficiently large level, the plasma begins to heat very efficiently according to an anomalous resistivity. An effective collision frequency was observed. A theoretical explanation of observed results is given.
Author (NSA)

N70-37081# Atomic Energy Commission, Washington, D.C. Div. of Research.
THE FUSION TORCH: A NEW APPROACH TO POLLUTION AND ENERGY USAGE
Bernard J. Eastlund and William C. Gough 7 Nov. 1969 27 p refs Presented at 62d Ann. Meeting on Waste Treatment Appl. of Radiation Chem., Washington, D.C., 16-20 Nov. 1969
(Conf-691108-2) Avail: CFSTI

A new concept is described for the handling of large volumes of solid wastes in the future. The energy and material balance for processing U. S. municipal wastes in the year 2000 via this concept is compared with that for advanced incineration. Background discussion of the properties of a fusion plasma and a future fusion power system are given.
Author (NSA)

N70-37107# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Lab. Gas Ionizzati.
DYNAMIC STABILIZATION OF DRIFT WAVES IN A COLLISIONLESS PLASMA BY AC ELECTRIC FIELDS
M. Dobrowolny Jan. 1970 40 p refs
(LGI-70/1) Avail: CFSTI

The influence of an AC electric field parallel to the confining magnetic field on low frequency instabilities in an inhomogeneous collisionless low beta plasma was considered. A general dispersion relation was derived, valid for small amplitudes of the time varying field, for modulation and plasma mode frequencies much smaller than the ion cyclotron frequency. The formalism was applied to a variety of drift instabilities and the flute instability in a Maxwellian plasma. Possibilities of dynamic stabilization were found for the majority of the drift waves. Corresponding stability criteria in terms of the electric field amplitude and conditions on the modulation frequency are given.
Author (ESRO)

N70-37123# Wisconsin Univ. Madison. Dept. of Physics.
MEASUREMENT OF PLASMA CONDUCTIVITY FOR ELECTRIC FIELDS LARGER THAN THE RUNAWAY FIELD
D. E. Lencioni [1969] 11 p refs Sponsored by AEC
(COO-1726-42) Avail: CFSTI

The electric conductivity parallel to a magnetic field of a hot-ion hydrogen plasma was measured for electric fields larger than the runaway field. The conductivity was found to be proportional to the plasma density with a value much less than Spitzer's conductivity but larger than Buneman's turbulent conductivity. When the current became comparable to the electron thermal current, the conductivity was found to decrease.
Author (NSA)

N70-37144# Royal Inst. of Tech., Stockholm (Sweden). Div. of Electron Physics.
TEMPERATURE, METAL VAPOUR DENSITY, AND ENERGY BALANCE IN AN ARGON SHIELDED WELDING ARC WITH IRON ELECTRODES
K. Acinger, L. Sipek, and E. Smars 11 May 1970 8 p refs Sponsored jointly by Board for Tech. Develop., Roy. Swed. Acad. of Engr. Sci., Elektriska Svetnings A.B. (ESAB), and AGA A.B.
(Rept-70-10) Avail: CFSTI

Spectroscopic and calorimetric measurements on a 200–300 Amp arc, 5–10 mm long with a 1.2 mm continuously supplied and melting iron wire as anode, are described. Near the arc centre, the intensity ratio of two neutral copper lines gave a maximum temperature of 8,000 K; Saha's equation gave 5% ionization and 10% metal vapour. Calorimetry showed that the solid iron plate cathode received 70–80% of the energy input. Calorimetry on a cooled copper cathode with a central hole showed 6% radiation losses, 9% of input energy transported by gas and 30% by melted metal. The metal droplets were at boiling point, and 5% evaporated during transport
Author (ESRO)

N70-37183# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
RADIO FREQUENCY RADIATION OF A REENTRY PLASMA STUDIED IN A HYPERSONIC WIND TUNNEL [ETUDE, EN SOUFFLERIE HYPERSONIQUE, DE L'EMISSION RADIOELECTRIQUE D'UN PLASMA DE RENTREE]
Jean-Michel Gratias (Ph.D. Thesis–Paris Univ.) 1969 59 p refs In FRENCH; ENGLISH summary
(ONERA-NT-155) Avail: CFSTI

The UHF radiation transmitted by the plasma surrounding a model placed in the hypersonic flow of a hot-shot wind tunnel (Mach 18, stagnation temperature 6000 K) was studied. This report includes a bibliographical study of plasma radiation mechanisms and a description of the experimental analysis of the radio noise in the 2–8 GHz band of the antennas and calibration devices used. In the explored pressure range of about 0.001 mb, these experiments showed a non-polarized radiation, whose intensity and frequency distribution suggested a radiation mechanism of thermal origin.
Author (ESRO)

N70-37189# Royal Inst. of Tech., Stockholm (Sweden). Div. of Electron Physics.
ON THE THEORY OF THE LOW PRESSURE POSITIVE COLUMN AT HIGH CURRENT DENSITIES
Staffan Torven May 1970 37 p refs
(Rept-69-18) Avail: CFSTI

A stationary gas discharge plasma was investigated at such low pressure that collisions between positive ions and other particles could be neglected. The concepts of plasma approximation and sheath approximation are analyzed and the results are applied to the plane symmetric discharge. When single-stage ionization is considered and the balance between the net fluxes of positive ions and neutrals is taken into account, it is shown that the stationary plasma density is uniquely determined by the velocity and density of the inward gas flux at the plasma boundary, the electron temperature, and the ionization rate. Limits for the maximum obtainable plasma density are calculated for the plane discharge bounded by wall sheaths and, in a simplified model, for a plasma bounded by a double space charge layer. It is suggested that the gas is in a maximally ionized stationary state when limitation of the steady discharge current occurs and nonlinear instabilities (arc chopping, stenotron oscillations) appear in a low pressure discharge.
Author (ESRO)

N70-37278# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Lab. Gas Ionizzati.
COLLISIONLESS DRIFT INSTABILITIES WITH ARBITRARY PHASE VELOCITY
A. Nocentini Oct. 1969 29 p refs
(LGI-69/14) Avail: CFSTI

The local dispersion relation for drift instabilities was studied with the Nyquist diagram technique. A stability condition for Q-machines is derived and discussed.
Author (ESRO)

N70-37361# United Kingdom Atomic Energy Authority, Culham (England).
MASS ANALYSER FOR USE IN MAGNETICALLY CONFINED PLASMA STREAMS
D. E. T. F. Ashby, J. N. Burcham, and R. G. Chambers Nov. 1969 5 p refs
(CLM-R-102) Avail: AEC Depository Libraries; HMSO: 1s 2d; BIS $0.30

A time-of-flight analyzer was designed to measure the charge/mass ratio of the ions of a plasma streaming in a uniform parallel magnetic field. The analyzer was tested in plasmas of number density from 10 to the 10th power to 10 to the 11th power/cu cm, in which the ions have thermal and streaming energies of about 50 eV. Author (NSA)

N70-37452*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SOLAR FLOW PARAMETERS
Klaus Schocken 16 Sep. 1969 30 p refs
(NASA-TM-X-53916; MSFC-IN-SSL-T-68-4) Avail: CFSTI CSCL 20I

The solar plasma is assumed to be a fully ionized mixture of two species. Nine important nondimensional parameters are obtained from the fundamental equations of plasma flow. Some thermodynamic properties of the solar plasma are presented in tables which are based on a computed solar model. Author

N70-37536# Atomic Energy Commission, Washington, D.C. Div. of Research.
THE FUSION TORCH: UNIQUE APPLICATION OF ULTRA HIGH TEMPERATURE PLASMA
Bernard J. Eastlund and William C. Gough 18 Aug. 1969 24 p refs
(TID-25412) Avail: CFSTI

The physics of the interactions in a fusion torch is discussed. Specific applications of the fusion torch such as material processing and ultraviolet radiation production are discussed. NSA

N70-37600# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
ANALYSIS OF IONS EXTRACTED FROM A PLASMA PUFF IN MAGNETIC GUIDE FIELDS
C. S. Leffel, Jr. Mar. 1970 45 p refs
(Contract NOw-62-0604-c)
(AD-707346; APL-TG-1108) Avail: CFSTI CSCL 20/9

An iron skimmer and an extractor tube were used to extract ions from a high-beta plasma puff as it traveled down B sub z and octopole magnetic guide fields. The plasma puff was generated by a theta-pinch plasma gun operating with hydrogen. The extracted ions were analyzed with a cross-field velocity analyzer in series with an electrostatic energy analyzer. For the case of the octopole guide field, analysis of the energy spectrum yielded values for the plasma parameters in good agreement with other determinations. For the B sub z guide field, the magnetic field trapped in the extraction apparatus produced a magnetic barrier that reflected the plasma so as to distort the energy spectrum and produced temperature estimates that were too high and density estimates that were too low. However, for the B sub z guide field, an upper limit could be placed on the concentration of impurity ions. Author (TAB)

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N70-36218# Watervliet Arsenal, N.Y. Benet Labs.
MATHEMATICS OF ELECTRONIC BAND STRUCTURE CALCULATIONS FOR LATTICES WITH MORE THAN ONE ATOM PER PRIMITIVE CELL
Donald M. Gray Jan. 1970 48 p refs
(AD-701053; WVT-7005) Avail: CFSTI CSCL 20/12

A general treatment for the symmetrization of trial expansion functions of both atomic-like and plane wave type is given for a crystal with more than one atom per primitive cell. It is assumed that these expansion functions are being used in a modified plane wave or similar method of band structure calculation. The pertinent integrals involving these symmetrized functions are constructed. Two subsequent parts of this report will apply the treatment to the Cu3Au structure (Part II) and exhibit the form of spin-orbit perturbation integrals for this structure type (Part III). It is tentatively planned to continue the series with one or more parts concerning symmetrization for the Augmented Plane Wave method. Author (TAB)

N70-36242# Martin Marietta Corp., Baltimore, Md. Research Inst. for Advanced Studies.
EFFECTS OF ENVIRONMENT ON THE FRACTURE BEHAVIOR OF NON-METALS Final Report, Apr. 1963–Apr 1970
Albert R. C. Westwood 15 Apr. 1970 29 p refs
(Contract Nonr-4162(00))
(AD-704614; RIAS-TR-70-5C) Avail: CFSTI CSCL 20/2

Topics discussed involve (1) Measurements of the cleavage surface energy's of 100 Mg O and 100 KCL, (2) Studies of the characteristics and mechanism of the complex-ion embrittlement of Ag Cl, (3) Studies of the nature and mechanism of Rebinder-type effects in ionic crystals such as Mg O and Ca F2, (4) An investigation of the influence and mechanism of Rebinder effects in the drilling of ceramics, (5) Preliminary results from a study of the adsorption-sensitive fracture and drilling behavior of a soda-lime glass. Technical reports and publications resulting from this contract also are listed. Author (TAB)

N70-36258# Catholic Univ. of America, Washington, D.C. Inst. of Ocean Science and Engineering.
THERMAL CONDUCTIVITY MEASUREMENTS OF LEAD TELLURIDE SAMPLES
David A. Didion and Mahn H. Hahn 30 Nov. 1969 25 p refs
(Contract N00014-67-A-0377-0003)
(AD-705221; Rept-69-8) Avail: CFSTI CSCL 20/12

Four samples of lead telluride were tested and their thermal conductivity determined over a temperature range of 325 degrees K to 575 degrees K. The cut-bar method was employed and <10% accuracy is claimed. A specimen of Pyroceram which had been cut from an independently measured chunk was used to calibrate the apparatus over the temperature range of concern. A brief mathematical analysis used in designing the apparatus is included. Author (TAB)

N70-36263# Hughes Aircraft Co., Culver City, Calif. Electronic Properties Information Center.
SUPERCONDUCTING THIN FILMS OF THE GROUP 2 AND 3 ELEMENTS, DATA SHEETS
Donald L. Grigsby Feb. 1970 186 p refs
(Contract F33615-68-C-1225)
(AD-704554; EPIC-DS-165) Avail: CFSTI CSCL 20/3

Data are presented on the superconducting properties of thin films of beryllium, zinc, cadmium and mercury from the group II elements and aluminum, gallium, indium, lanthanum and thallium from the group III elements. These properties include transition temperature, superconducting energy gap, critical magnetic field and critical current when the data are available in the literature. Author (TAB)

N70-36276# Sigmatron, Inc., Goleta, Calif.
ELECTROLUMINESCENT THIN FILM RESEARCH Interim Technical Progress Report, 30 Jun. 1967–30 Sep. 1968
E. J. Soxman 29 Apr. 1969 65 p refs
(Contract Nonr-4509(00))
(AD-704536; JANAIR-690410; EL-5) Avail: CFSTI CSCL 20/3

Through continued development and control of deposition parameters, EL thin films were fabricated with improved reproducibility. Two categories of characteristics were correlated in a phenomenological way with film preparation techniques. On one hand, films capable of modest maximum luminance but long life were prepared. On the other hand were films capable of extremely high maximum luminance but with short times to half-brightness. Improvements in dielectric strength were made with an additional layer. Oxygen added during phosphor deposition decreased the turn-on time. A 7 inch x 7 inch crossed electrode, ultrahigh contrast EL panel with 258 x 258 elements was made for evaluation as a multiformat display. A dual bargraph vertical scale EL display was demonstrated in the form of an engine performance indicator.
Author (TAB)

N70-36284# Picatinny Arsenal, Dover, N.J.
SOME EXPERIMENTS ON SWITCHING-TYPE AMORPHOUS SEMICONDUCTORS
P. Calella, S. Defeo, W. Doremus, J. Hall, and R. Nicolaides Jan. 1970 40 p refs
(AD-703858; PA-TR-3935) Avail: CFSTI CSCL 20/12

Several experiments have been conducted which yield information pertinent to establishing some of the behavioral characteristics of amorphous semiconductor switching. Results of such experiments, considered in conjunction with other findings, define conditions which must be accounted for in theoretical interpretation and also point out the direction which further research should take.
Author (TAB)

N70-36304# Indiana Univ., Bloomington.
FRACTURE IN BRITTLE SOLIDS Final Report, 1 Jul. 1967–1 Sep. 1969
T. Y. Thomas Apr. 1970 10 p refs
(Grant DA-ARO(D)-31-124-G928)
(AD-704358; AROD-7211-9-MC) Avail: CFSTI CSCL 20/2

An investigation was made of the conditions under which slip and fracture will occur in a brittle solid. Special attention was given to the effects of hydrostatic pressure.
TAB

N70-36308# Helsinki Univ. (Finland).
NON-OHMIC EFFECTS IN HEXAGONAL SELENIUM SINGLE CRYSTALS
Simo O. Hemila (Ph.D. Thesis) 1969 43 p refs
(APS-PH-69) Avail: CFSTI

Conductivity transients occured when the field was changed, and these transients depended strongly on illumination. In every crystal studied the low field conductivity during the decay of photoconductivity could be quenched by applying a higher field, both at 300 K and at 80 K. In every crystal these effects started at very low fields, below 100 V/cm, but their amplitude varied considerable from crystal to crystal. Still stronger non-ohmic effects were observed at 80 K in the dark, a steady state characteristics I is equivalent to U sup n was observed with n approximately 3. Some pulse measurements were also carried out. This non-ohmic behavior is a bulk effect and seems to be caused by crystal imperfections native to selenium. An electric field both increases the conductivity and increases the recombination rate of holes in Se single crystals. Results obtained at room temperature and in illuminated crystals also at lower temperatures can be interpreted by using a dislocation recombination model earlier applied to the photoconductivity results of Se.
E.H.W.

N70-36307# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LIMITING EQUILIBRIUM OF BRITTLE SOLIDS WITH FRACTURES
V. V. Panasyuk 18 Dec. 1969 326 p refs Transl. into ENGLISH from Predelnoe Ravnovesie Khrupkikh Tel s Treshchinami (Kiev), 1968 p 1–246
(AD-703153; FTD-MT-24-189-69) Avail: CFSTI CSCL 20/12

The monograph analyzes the theoretical principles of a quasistationary equilibrium of brittle solids with fractures. The results of investigations which were carried out by the author on the theory of propagation of fractures in a deformable solid are generalized and calculated model diagrams for such problems are given. Solutions of new plane and three-dimensional problems on a limiting equilibrium of brittle solids with fracture are shown. An attempt is made to formulate the elements of the theory of brittle destruction of deformable solids with fracture defects.
TAB

N70-36317# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
THE ROTATIONAL RAMAN EFFECT. MOLECULAR IMPURITIES IN ALKALI HALIDES
R. Callender and P. S. Pershan Jan. 1970 82 p refs
(Contract ARPA SD-88)
(AD-704527; ARPA-TR-39) Avail: CFSTI CSCL 20/12

Raman scattering of light from representative alkali halide crystals containing CN(-), NO2(-), OH(-), and OD(-) impurities is reported and analyzed. The observed spectra have a low frequency range, in which the scattered light is usually shifted from the incident light by less than 300 to 400/cm, and a high frequency range in which the shifts are typically 1000 to 2000/cm. Although the low frequency region does not readily lend itself to quantitative analysis it is clear that its main features can be interpreted in terms of a mixture of second order scattering from the pure host, impurity induced first order scattering that results from perturbing the pure host, and scattering from the rotational degrees of freedom of the molecular impurity. The high frequency region, on the other hand, consists of spectra whose frequencies are characteristic of the internal normal coordinates of the molecule. A very narrow totally polarized line with depolarized sideband structure is generally observed.
Author (TAB)

N70-36324# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
THE ENHANCEMENT OF LEAD SELF-DIFFUSIVITY BY GOLD AND SILVER ADDITIONS
J. Wesley Miller Feb. 1970 27 p refs
(Contract N00014-67-A-0298-0009; ARPA SD-88)
(AD-704724; TR-27) Avail: CFSTI CSCL 20/12

It is proposed that noble metal solutes diffuse in lead primarily by the interstitial mechanism, while cadmium solute diffuses by means of tightly-bound interstitial-vacancy pairs. It is reasoned that noble metal interstitial ions should also interact attractively with lead vacancies and result in a small enhancement of the self-diffusivity with solute additions. Consequently, lead self-diffusivity has been measured as a function of small gold and silver solute additions. The linear enhancement factors determined from these measurements are most consistent with the interpretation that noble metal solutes diffuse primarily by the interstitial mechanism, and that the relatively small enhancements of lead self-diffusion are due to attractively bound interstitial-vacancy pairs.
Author (TAB)

N70-36342# Sigmatron, Inc., Goleta, Calif.
ELECTROLUMINESCENT THIN FILM RESEARCH Interim Technical Progress Report, 30 Sep. 1968–9 May 1969
E. J. Soxman 23 May 1969 40 p refs
(Contract Nonr-4509(00))
(AD-704537; JANAIR-690513) Avail: CFSTI CSCL 20/3

During the period covered in the sixth interim technical report an investigation of new deposition techniques and layer structure of electroluminescent panels was undertaken, new phosphor activators and dielectric layers were explored, procedures for testing and correlating performance characteristics and processes for replicating panels with desired characteristics were established, sealants for environmental protection were evaluated, and solid-state circuitry used in several demonstration display devices was developed. Author (TAB)

N70-36404# Hughes Aircraft Co., Culver City, Calif. Electronic Properties Information Center.
LINEAR ELECTROOPTIC MODULATOR MATERIALS
John T. Milek and Sheldon J. Welles Jan. 1970 275 p refs
(Contract F33615-68-C-1225)
(AD-704556; EPIC-S-14) Avail: CFSTI CSCL 20/6

A comprehensive survey is presented of all important properties of 13 linear electrooptic materials: KDP, KDDP, KDA, ADP, KTN, lithium niobate, lithium tantalate, cuprous chloride, barium sodium niobate, proustite, calcium pyroniobate and bismuth germanium oxide. Author (TAB)

N70-36533# Battelle Memorial Inst., Columbus, Ohio.
A MODIFIED LINEAR RESPONSE METHOD FOR OBTAINING THE SPIN DIFFUSION CONSTANT OF A RIGID DIPOLE SYSTEM Annual Technical Report, 22 May 1969–22 May 1970
Jerome I. Kaplan 22 May 1970 10 p refs
(Contract N00014-69-C-0218)
(AD-706044) Avail: CFSTI CSCL 20/12

The spin diffusion constant D is obtained for a lattice of spin 1/2 particles with dipole-dipole coupling. The method of calculation is to create an equilibrium state with a non-uniform magnetization which is then allowed to relax after removal of the small inhomogeneous applied magnetic field. Comparison of the relaxation as calculated from a microscopic and macroscopic point of view defines D. Author (TAB)

N70-36540# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF GAMMA IRRADIATION ON THE ELECTRICAL CHARACTERISTICS OF SPECIALLY PURE SILICON
S. V. Starodubtsev et al 20 Aug. 1969 11 p refs Transl. into ENGLISH from the Russian
(AD-700519; FTD-HT-23-537-68) Avail: CFSTI CSCL 20/12

This is a continuation of earlier research which showed that silicon with low impurity content does not change its resistivity when bombarded by fast electrons. The present article describes the results of irradiation of highly purified silicon with gamma rays. Single-crystal silicon was obtained by crucible-less zone melting in highly purified hydrogen. The change in the electric characteristics was determined by measuring the Hall effect and the resistivity at temperatures from 160 to 330K. Plots are presented of the dependence of the relative change in the Hall mobility of the carriers on the gamma irradiation dose, of the temperature dependence of the Hall mobility for pure and ordinary samples, the relative change of carrier density as a function of the gamma irradiation dose, and the temperature dependence for the pure and ordinary samples, as well as the temperature dependence of the Fermi levels calculated from the experimental data. The results show that whereas in ordinary samples the number of carriers gradually decreased with increasing dose, pure samples showed a marked increase with increasing density, above a certain minimal dose. Author (TAB)

N70-36545# South Dakota School of Mines and Technology, Rapid City. Dept. of Physics.
THE THERMAL CONDUCTIVITY OF EUROPIUM SULFIDE ACROSS THE CURIE TEMPERATURE
Rees D. Morgan 15 Nov. 1969 83 p refs
(Contract N00014-69-A-0100-0001)
(AD-704498; TR-26) Avail: CFSTI CSCL 20/12

The thermal conductivity of a polycrystalline sample of EuS has been measured over the temperature range of 13.5 K to 17.6 K. This range includes the Curie temperature of 16.4 K. The linear absolute method was employed. There was no apparent anomalous behavior for the experimental thermal conductivity in the vicinity of the Curie temperature such as has been observed in EuO and a number of other magnetic materials. The possibility of observing an anomaly in the conductivity near the magnetic transition temperature due to critical phonon-magnon scattering has evidently been masked by the large phonon-dislocation scattering. Author (TAB)

N70-36665*# Lockheed Missiles and Space Co., Huntsville, Ala.
SPACE ENVIRONMENTAL EFFECTS ON SOLIDIFICATION STUDY: ZERO-GRAVITY SOLIDIFICATION Final Report
P. G. Grodzka Mar. 1970 57 p refs
(Contract NAS8-21123)
(NASA-CR-102696; HREC-1123-2; LMSC/HREC-D148619) Avail: CFSTI CSCL 20/12

A theoretical analysis of the influence of various zero-gravity effects on solidification was conducted. Results of this analysis made possible the designation of five specific single crystals as candidates for manufacture in space orbit. The five candidates are silicon, germanium, KTN, BANANAS (barium, sodium niobate), and CuCl. Also, a number of considerations pertinent to space processing concepts and mathematical analysis theory are discussed. Author

N70-36760# State Inst. for Technical Research, Helsinki (Finland).
ON THERMAL OXIDATION OF SILICON IN STEAM
M. Leppihalme, S. Leppaevuori, and M. Malmelin 1970 12 p refs
Avail: CFSTI

The thermal growth of silicon dioxide was studied by oxidizing n-type silicon crystals with a 0.01 ohm cm specific resistivity in steam and measuring the thickness of the oxide formed. The result showed that the oxide growth under these experimental conditions satisfied previous determinations. E.M.C.

N70-36805* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PRODUCTION OF HIGH PURITY SILICON CARBIDE Patent
Noel T. Wakelyn and Robert A. Jewell, inventors (to NASA) Issued 23 Mar. 1965 (filed 5 Sep. 1962) 5 p Cl. 23-208
(NASA-Case-XLA-00158; US-Patent-3,174,827; US-Patent-Appl-SN-221637) Avail: US Patent Office CSCL 20L

A process is described for production of small quantities of high purity silicon carbide on a carbon base, by the hydrogen reduction of silicon tetrachloride, with crystals being developed from the gaseous phase of the reactive materials. A hydrogen gas is saturated with silicon tetrachloride and flowed under pressure through a constricted passageway within a high temperature furnace onto a carbonaceous base or model member. The carbonaceous member extends forward and aft of the constricted furnace area, with silicon carbide crystal formation taking place in large quantity on the carbon model only on the portion positioned aft of the constructed passageway. R.B.

N70-36844*# Radio Corp. of America, Princeton, N.J. Astro Electronics Div.
STUDY TO DETERMINE AND IMPROVE DESIGN FOR LITHIUM-DOPED SOLAR CELLS Quarterly Report, 1 Apr.–30 Jun. 1970

G. Brucker, T. Faith, J. Corra, and A. Holmes-Siedle 10 Jul. 1970 41 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952555)
(NASA-CR-112863; AED-R-3601F; QR-4) Avail: CFSTI CSCL 20L

A program for studying the action of lithium in producing a recovery or spontaneous annealing of radiation damage in bulk silicon and silicon solar cells at room temperature or below is analyzed. The test vehicles used for this work are a group of solar cells supplied, and silicon bars in the Hall-bar configuration. The source of particle irradiation being used is a 1-MeV electron beam produced by a Van de Graaff generator. Author

N70-36854# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France). Faculte des Sciences.
THE PHASE TRANSITIONS OF THE CLASSICAL HARD-ELLIPSE SYSTEM
Jacques Vieillard Jun. 1970 48 p refs
(Rept-70/25) Avail: CFSTI

By Monte Carlo calculations in the canonical ensemble, some properties were studied of a two-dimensional system of 170 long hard ellipses. This system can be considered as a two-dimensional model for a nematic liquid crystal. This system exhibits two first-order phase transitions; a solid-nematic type phase transition at high density, and a disorientation phase transition at a density 1.5 times smaller. This result suggests that excluded volume effects might play an essential role in the disorientation phase transition of nematic liquid crystals. Author

N70-36891*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Astrionics Div.
ASTRIONICS RESEARCH
In its Space Programs Sum. No. 37-62, Vol. 3 30 Apr. 1970 p 212–213 refs (See N70-36876 20-34)
Copyright. Avail: CFSTI CSCL 20L

Thin film Josephson junctions for nanosecond switching-time computer elements that can be fabricated at high densities with microcircuit techniques are considered. Major problems are analyzed concerning low yield fabrication techniques, unstable junction characteristics, and junction deterioration at room temperature during storage. Preliminary test results are discussed for a junction formed by anodically oxidizing tantalum and by overlaying the oxide with a superconducting thin film. J.A.M.

N70-36961# Eidgenossischetechnische Hochschule, Zurich (Switzerland).
SPONTANEOUS MAGNETOELASTIC EFFECTS IN SOME RARE EARTH COMPOUNDS. 1 [EFFETS MAGNETOSTRICTIFS SPONTANES DE QUELQUES COMPOSES DES TERRES RARES, 1]
Francis Levy (Ph.D. Thesis) 1969 38 p refs In FRENCH; ENGLISH summary Submitted for publication Supported in part by Swiss Govt.
(Rept-4337) Avail: CFSTI

Studies are presented relating to the europium chalcogenides and to the LnX compounds, Ln representing one of the rare earth elements and X representing one of the elements P, As or Sb. With regard to EuO and EuS, X-ray measurements as a function of the temperature of the crystal lattice parameters reveal a volume reduction when these crystals are cooled through the Curie temperature. This contraction can be assigned to the exchange-striction, and the relative volume variation is proportional to the spin correlation. This magnetoelastic interaction is described within the molecular field approximation. The crystal lattice parameters of some trivalent compounds of the rare earth LnX were measured between room temperature and liquid helium temperature. The rocksalt structure of these anti-ferromagnetic crystals undergoes an anisotropic distortion at the Neel point. The Tb(3+) compounds shrink along a trigonal direction, and those with Nd(3+), Dy(3+) or Ho(3+) along a tetragonal axis. This perturbation of the crystal field potential lowers the ground state energy level in the J-multiplet of the magnetic ion. The level splitting is distorted octahedral fields is calculated with the operator equivalent technique, and the eigenvalues are expressed as a function of a distortion parameter. Author

N70-36988# Cambridge Univ. (England). Chemical Lab.
OFFICE FOR SCIENTIFIC AND TECHNICAL INFORMATION Annual Report, Jan. 1969–Jan. 1970
1970 64 p
(OSTI-5064; Rapt-1-70) Avail: CFSTI

This report deals with the expansion of the crystal structure library, coordination of work on interatomic distances obtained from solid-state and gas-phase investigations, computer handling of bibliographic records, and research on organic structures. ESRO

N70-37017# Signals Research and Development Establishment, Christchurch (England).
Si-ZnS HETEROJUNCTIONS. PART 2: SINGLE CRYSTAL FILMS OF ZINC SULPHIDE ON SILICON
J. S. Hill, T. G. R. Rawlins, and G. N. Simpson Jan. 1970 41 p refs
(SRDE-69049) Avail: CFSTI

A technique for the growth of single-crystal epitaxial films of zinc sulphide on silicon has been evolved. The film is grown by condensation of the vapour sublimed from a zinc sulphide source in ultrahigh vacuum. Optical, electron, and scanning electron microscopy were used to examine the topography of the films produced, and X-ray and electron diffraction studies were used to evaluate the crystal structure of the deposits and substrates. Author (ESRO)

N70-37028*# Hiram College, Ohio. X-Ray Physics Lab.
DEFECT PRODUCTION IN SINGLE CRYSTALS RESULTING FROM ION BOMBARDMENT Final Status Report, Jun. 1966–Dec. 1969
Lawrence B. Shaffer 22 May 1970 66 p refs
(Grant NGR-36-019-001)
(NASA-CR-112875) Avail: CFSTI CSCL 20B

The application of standard X-ray techniques to the determination of certain thermodynamic properties of cesium gas is discussed, including the experimental techniques and equipment. The design, fabrication, final configuration, and deficiencies of the equipment used in the single crystal damage studies are described, along with the experimental technique utilized. The results of the investigation are given for silicon, copper, and germanium, and are stated to be generally inconclusive. P.A.B.

N70-37048# Signals Research and Development Establishment, Christchurch (England).
ANTI-STOKES EXCITED EDGE EMISSION IN CADMIUM SULPHIDE
M. R. Brown, A. F. J. Cox, and J. M. Williams Jan. 1970 28 p refs
(SRDE-70002) Avail: CFSTI

This report presents a detailed study of the variations in the structure of blue and green edge emissions on Stokes and anti-Stokes excitation for a range of doped and undoped CdS samples at 4.2 K. The observed variations are interpreted on a model that links them with the state of ionisation of the anti-Stokes active centre in the two excitation conditions. The model emphasises the role of the centres normally associated with deep centre luminescence as the ones associated with the edge emissions. Author (ESRO)

N70-37115# Signals Research and Development Establishment, Christchurch (England).
STOKES AND ANTI-STOKES EXCITED VISIBLE EMISSION IN CADMIUM SULPHIDE AND CADMIUM SULPHIDE/SILVER
M. R. Brown, A. F. J. Cox, W. A. Shand, H. Thomas, and J. M. Williams Jan. 1970 35 p refs
(SRDE-70001) Avail: CFSTI

Cadmium sulphide recombination centres giving emission in the 2.40 eV and 2.0 eV energy regions were studied under both Stokes and anti-Stokes excitation. The emissions in the 2.0 eV region were more complex than had hitherto been supposed. The nature of the emitted radiation is contrasted for both types of excitation and the significance of two photon versus single photon excitation is discussed. The sensitivity of the visible luminescence to infrared radiation in the 0.6 eV region is discussed in relation to the energy level model. Author (ESRO)

N70-37156# California Univ., Berkeley. Lawrence Radiation Lab.
INTERACTION OF HIGH FREQUENCY ELECTROMAGNETIC RADIATION OF SUPERCONDUCTING POINT CONTACT JUNCTIONS
Stewart Allen Sterling (Ph.D. Thesis) Dec. 1969 99 p refs
(Contract W-7405-eng-48)
(UCRL-19096) Avail: CFSTI

Experimental evidence is presented on the interaction of millimeter and submillimeter electromagnetic radiation with point contact Josephson junctions. Changes in the dc current–voltage characteristic are used to measure changes in ac Josephson currents coupled to radiation fields, and the detection properties of such junctions are discussed in detail. Evidence is presented for feedback-narrowed response when the ac Josephson currents are strongly coupled to a resonant cavity. The observed response shows high sensitivity and frequency selectivity. The Werthamer–Shapiro theory was extended to include the effects of applied radiation at the resonance frequency and is shown to account for the feedback narrowing. In addition, evidence for the frequency dependence for the ac currents is presented. Author (NSA)

N70-37178# Oklahoma Univ., Norman. School of Chemical Engineering and Materials Science.
THE EFFECTS OF SURFACE COATINGS ON THE PLASTIC DEFORMATION OF METAL SINGLE CRYSTALS Progress Report, 15 May 1969–15 Feb. 1970
Robert Jay Block 15 Feb. 1970 4 p refs
(Contract AT(40-1)-3401)
(PB-189889; ORO-3401-11) Avail: CFSTI CSCL 20/2

Research work completed during the current contract period is described in the manuscripts: Reply to Comments on 'The Existence of Preferential Surface Deformation in Copper Single Crystals', 'The Mechanical Behavior of Anodic Coatings on Deformed Aluminum', and 'Buckling of Anodic Coatings'. Work in progress involves studies of evaporated coatings on the mechanical properties of crystals, dislocation arrangements in deformed copper crystals and a further analysis of the buckling of surface coatings. USGRDR

N70-37191# Oak Ridge National Lab., Tenn.
THERMALLY STIMULATED EXOELECTRON EMISSION FROM TERRESTRIAL AND LUNAR MINERALS
Klaus Becker Feb. 1970 19 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2869) Avail: CFSTI

Preliminary results on the release of low-energy electrons from the surface of several unirradiated and preirradiated terrestrial minerals (dunite, andesite, granodiorite, granite, and basalt) and from lunar soil (10065-20) during linear heating inside a gas-flow GM counter are reported. A pronounced emission peak at approximately 495 C, was observed only in granodiorite before irradiation. After exposure to a high gamma radiation dose several peaks at temperatures between approximately 140 and approximately 500 C were observed in some of the terrestrial minerals, and peaks at approximately 150 C, approximately 275 C and approximately 475 C in the lunar material at a heating rate of 2 C/sec. Some preliminary experiments on the dose response and the heating rate dependence of the peak locations were carried out, and possible implications for further studies are discussed. Author (NSA)

N70-37306# Atomic Energy Establishment, Winfrith (England). Fast Reactor Physics Div.
H-EXCOH: A PROGRAMME FOR COMPUTING COHERENT ELASTIC SCATTER FROM HEXAGONAL POLYCRYSTALS
A. T. D. Butland Nov. 1969 15 p refs
(AEEW-M-954) Avail: AEC Depository Libraries; HMSO 3s; BIS $0.60

HEXCOH is a computer code written in FORTRAN II for the KDF9 computer to evaluate the isotropic and linearly anisotropic coherent elastic neutron cross sections in an isotropic polycrystalline solid with a close packed hexagonal lattice structure. The code can only be used at present for graphite, beryllium and beryllium oxide but may be easily extended to include other solids with hexagonal lattices. The cross sections can be computed as averaged values over a weighting spectrum and between energy boundaries specified in the input, or as point values. NSA

N70-37537# California Univ., Berkeley. Lawrence Radiation Lab.
LOW TEMPERATURE HEAT CAPACITIES OF SUPERCONDUCTING DEGENERATE SEMICONDUCTORS
N. E. Phillips, B. B. Triplett, R. D. Clear, H. E. Simon, J. K. Hulm (Westinghouse Res. Labs.) Dec. 1969 12 p refs Presented at Conf. on Sci. of Superconductivity, Stanford, Calif.
(Contract W-7405-eng-48)
(UCRL-19163; CONF-690831-1) Avail: CFSTI

Low temperature heat capacities of a number of samples of SnTe and SrTi03 with varying carrier densities (n sub c) were measured. For SnTe, the Debye temperature is practically independent of n sub c. The coefficient of the electronic heat capacity gamma varies regularly with n sub c but in a more complicated way than expected for a simple band. The SrTi03 samples all show appreciable deviation from the temperature dependence expected for the sum of lattice and electronic contributions and, consequently, the values of gamma and Debye temperature are uncertain. For a Nb-doped SrTi03 sample, the increase in heat capacity with applied magnetic field is very much smaller than for a reduced sample with similar n sub c. This provides further support for the author's earlier suggestion that the difference in T sub c between Nb-doped and reduced samples, and possibly the maximum in T sub c for reduced samples, is related to the presence of paramagnetic ions. Author (NSA)

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N70-36238# Columbia Univ., New York. Dept. of Civil Engineering and Engineering Mechanics.
[DEPARTMENT OF CIVIL ENGINEERING AND ENGINEERING MECHANICS] Final Report, 1960-1969
Alfred M. Freudenthal Mar. 1970 15 p refs

(Contract Nonr-266(78))
(AD-705488; TR-43) Avail: CFSTI CSCL 21/9,2

A summary is given of research which emphasized (a) problems of material characterization that are relevant to real operating conditions of propellant grains and thus to their design; (b) problems of analysis that reflect the observation that solid propellants of the high filler content used are quasi-homogeneous and quasi-continuous only at the very small strains that are far removed from conditions of incipient failure, as well as (c) problems arising from the desire to increase the operating burning pressures in the grain to an extent that would require the use of circumferential wire reinforcement. TAB

N70-36487# Naval Postgraduate School, Monterey, Calif.
AN EXPERIMENTAL INVESTIGATION OF THE SENSITIZATION OF ALIPHATIC HYDROCARBON FUELS
Dennis Raymond Laack Jun. 1969 55 p refs
(AD-704509) Avail: CFSTI CSCL 19/2

Jet aircraft fuels are relatively stable and safe to handle. Therefore they are not readily adaptable to weapons applications. A study of the sensitization of the jet fuel with solid additives was carried out. Comparisons between the mixtures with the different solid additives were made. An investigation of different ignition methods was also made to find a practical means of igniting the mixture. The results indicated that the jet fuel could be sensitized using a strong oxidizer in conjunction with either magnesium or red phosphorous. The fuel can also be ignited with a combination of chemicals. Author (TAB)

N70-36894*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Propulsion Div.
SOLID PROPELLANT ENGINEERING
In its Space Programs Sum. No. 37-62, Vol. 3, 30 Apr. 1970 p 228–234 refs (See N70-36876 20-34)
Copyright. Avail: CFSTI CSCL 21B

Effective nondestructive test techniques that measure the quality and expected performance of an electro-explosive device were studied. The test techniques investigated are: (1) transient pulse, (2) self-balancing bridge measurement, and (3) thermal follow display. It is concluded that a compact stepping switching is available to implement the proposed redundant switching arrangement for squib-firing circuits. F.O.S.

N70-36929* Aerojet Liquid Rocket Co., Sacramento, Calif.
SYSTEM ANALYSIS OF GELLED SPACE-STORABLE PROPELLANTS Final Report
Jul. 1970 98 p refs
(Contract NAS7-473)
(NASA-CR-112348; FR-1038-04F) Avail: CFSTI CSCL 21I

Liquid oxygen trifluoride was gelled with fine particles of OF3-BF3 and the gel was stored for 30 days at -196 C. The OF2 gel was flowed at four different gelant concentrations and at various diving pressures. At higher flow rates, the gels shear-thinned to a point that their flow behavior approached that of water. Bromine trifluoride, bromine pentafluoride and boron trifluoride were evaluated as gelants for OF2. In no case was a satisfactory gel obtained. Liquid diborane was gelled with fine particles of (CH3)3N-BF-3 and the gel was stored for 30 days at -156 C (210 R). The diborane gel was flowed at 5 different gelant concentrations and at various pressure drops. At higher flow rates, the gels shear-thinned to a point that their apparent viscosity was less than that of water at the same shear rate. Liquid diborane was gelled with fine particles of (CH3)3N-BH3. The storage stability of this gel did not meet program objectives. Gelled OF2 and gelled B2H6 do not core or cling to vessel walls while the gels are flowed; propellant acquisition and utilization will not be hampered by gelation. The flow behavior of particulate gels is discussed and the effect of gelation on propellant system performance has been determined. Author

N70-37132# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
CHLORINE PENTAFLUORIDE [LE PENTAFLUORURE DE CHLORE]
Roland Bougon Jan. 1970 56 p refs In FRENCH; ENGLISH summary
(CEA-R-3924) Avail: CFSTI

This report on chlorine pentafluoride includes a bibliography of articles published up to July 1969. Some original data on this subject are also printed. Author (ESRO)

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magneto-hydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N70-36358# General Applied Science Labs., Inc., Westbury, N.Y.
ANALYSES FOR THE DESCRIPTION OF ROCKET AND AIRBREATHING PROPULSION SYSTEM COMBUSTION CHAMBER AND NOZZLE FLOWS Annual Report
R. B. Edelman, O. F. Fortune, and G. Weilerstein Apr. 1970 75 p refs
(Contract NAS8-21387)
(NASA-CR-102820; GASL-TR-736) Avail: CFSTI CSCL 21B

The work described deals with analytical studies for the description of the coupled fluid mechanical and chemical kinetics processes occurring in rocket and air-breathing propulsion systems. The partial differential equations and numerical solution techniques for subsonic, supersonic, and mixed flows are presented. Calculations are given demonstrating the application of the analyses to combustion chamber and nozzle flow fields. Author

N70-36359*# Thiokol Chemical Corp., Brigham City, Utah.
THRUST VECTOR CONTROL (TVC) SYSTEM STUDY PROGRAM, VOLUME 1 Final Report Summary
15 Jun. 1970 57 p
(Contract NAS3-12040)
(NASA-CR-72727; TWR-4037-Vol-1) Avail: CFSTI CSCL 21H

A program was conducted to study various techniques that could be used for thrust vector control (TVC) on the 260 in. (6.6 m) solid rocket booster of a MLV SAT-1B-5A two stage launch vehicle. This study was structured such that three major categories of TVC were considered: liquid injection thrust vector control, movable nozzle flexible seal, and mechanical exhaust jet interference systems. Of all the techniques considered, two were selected as the most promising and were subjected to a detailed design and cost analysis with the object of developing a low cost, high reliability system. One of these two systems was a cold gas blowdown nitrogen tetroxide liquid injection TVC system with 16 electromechanical injector valves. The other technique selected was a passive cold gas blowdown movable nozzle flexible seal system with hydraulic actuators. On the basis of cost, weight, and relative simplicity, the movable nozzle flexible seal system is the superior approach. Author

N70-36360*# Thiokol Chemical Corp., Brigham City, Utah.
THRUST VECTOR CONTROL (TVC) SYSTEM STUDY PROGRAM, VOLUME 2 Final Report
15 Jun. 1970 280 p refs
(Contract NAS3-12040)
(NASA-CR-72727; TWR-4037-Vol-2) Avail: CFSTI CSCL 21H
For abstract see N70-36359.

N70-36361*# Boeing Co., Washington, D.C.
APOLLO SPACECRAFT ENGINE SPECIFIC IMPULSE, PART 2
Jeremy P. B. Cuffe 28 Oct. 1968 102 p refs
(Contract NASw-1650)
(NASA-CR-112414; D2-117060-2-Pt-2) Avail: CFSTI CSCL 21H

The methods used to determine the vacuum specific impulse are described, the various performance analysis procedures are discussed, and the data obtained on production configuration Apollo spacecraft engines are summarized. The following primary propulsion system engines, used in the Apollo service and lunar modules, are included: LM ascent engines, LM descent engine, and SM Engine. Author

N70-36378*# TRW Systems Group, Redondo Beach, Calif.
USER'S MANUAL FOR COMPUTER PROGRAM HEPCAT
C. C. Garza, E. Joseph, R. C. Meckley, D. J. Millet, and R. W. Pringle Jun. 1970 342 p
(Contract NAS9-8166)
(NASA-CR-108594; TRW-11176-H565-R0-00) Avail: CFSTI CSCL 21H

The purpose of the HEPCAT (Houston Engine Performance Calculation and Transient) computer program is to provide an engineering tool which can perform automatic data reduction and test data analysis in support of rocket engine test programs conducted at the MSC Thermochemical Test Area (TTA). The program is described, and both the user's and programmer's manuals are provided. The HEPCAT is functionally divided into three areas: data acquisition and reduction, steady state engine performance analysis, and the reduction of data to standard conditions for run-to-run test correlation. All of these functional areas of the program can be user specified to both read and output the test data in a sequential converted format. Data reduction takes place automatically when the user utilizes the steady state engine performance and the engine standarization options. The program has the flexibility to provide the user with the option to output any parameters available from calculations or measured data. Included in the user's manual is the engineering formulation, program operating instructions, validation sample case and the data tape format of the TTA SEL 600 Computer operating in mode 3. Author

N70-36415# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
BASIC TECHNICAL DATA OF THE ENGINE
E. L. Feldman 29 Sep. 1969 12 p Transl. into ENGLISH from Aviats. Turboreaktivnyi Dvigatel (Moscow), 1968 p 25–27
(AD-700477; FTD-MT-24-214-69) Avail: CFSTI CSCL 21/5

The document contains a list of data pertaining to the turbojet engine RD-3M-500. There is also a table giving operating conditions for the engine. TAB

N70-36419# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF THE REYNOLDS NUMBER ON TIP LOSSES
A. S. Maksudyan et al 5 Nov. 1969 13 p refs Transl. into ENGLISH from Ser. Tekhn. Nauk (USSR), v. 20, no. 2, 1967 p 53–59
(AD-700578; FTD-HT-23-247-68) Avail: CFSTI CSCL 21/5

An examination is made of the effect on the Reynolds number on tip losses in foil lattices and under conditions of a rotating turbine stage. The foil lattices were tested on a static stand, while the stages were tested on an experimental turbine. Careful finishing of the blade surfaces excluded the influence of roughness. Author (TAB)

N70-36530*# Arizona Univ., Tucson.
LINEAR STABILITY OF A NUCLEAR ROCKET ENGINE WITH TWO REACTIVITY FEEDBACKS
C. H. Lewis *In its* Res. in an Appl. of Mod. Autom. Control Theory to Nucl. Rocket Dyn. and Control Jan. 1970 33 p refs (See N70-36526 20-19)
Avail: CFSTI CSCL 21F

The nonlinear equations describing nuclear reactor behavior due to reactivity feedback from variation of temperature and moderator density in the core are analyzed. Parameter spaces are defined, and stability boundaries for the linearized system are determined. Analog computer solutions of the linearized equations are presented as verification of the stability of the system. Author

N70-36628*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ANNULAR SLIT COLLOID THRUSTER RESEARCH AND DEVELOPMENT
Kenneth W. Stark and William A. Burton Apr. 1970 61 p refs
(NASA-TM-X-65303; X-734-70-241) Avail: CFSTI CSCL 21C

Research in the optimization of performance and further study of the performance characteristics associated with the higher thrust annular slit colloid thruster are presented. It was observed that good performance was normally accompanied by a visible glow emanating from the annulus termed glow spray. Because the cause and effect relationship of the glow spray were unknown, it was decided to try to obtain the required performance in the absence of glow spray. It was reasoned that the glow intensity was dependent upon the propellant vapor background in the vacuum chamber; therefore, new propellant solutions with vapor pressures lower than that of the standard NaI-glycerol solution were sought, and reduced propellant flow rates were employed. Author

N70-36770*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Propulsion Div.
SOLAR ELECTRIC PROPULSION SYSTEM TESTS
E. V. Pawlik, E. N. Costogue, J. D. Ferrera, and T. W. Macie 15 Aug. 1970 47 p refs
(Contract NAS7-100)
(NASA-CR-112671; JPL-TR-32-1480) Avail: CFSTI CSCL 21C

The design and experimental evaluation of a solar electric primary propulsion system is described. The system consists of two electron-bombardment ion thrusters complete with the associated thrust vector aligning actuators, a switching network, controller, and a flight-type power conditioner. The system was operated over a 2:1 range in output power. System integration problems such as matching of thruster performance and response to arcing within the thruster and solutions to these problems are described. Short endurance tests of the system were undertaken. Noise within the system was the major lifetime-limiting factor for both the power conditioner and controller. Author

N70-36791*# Aerojet Solid Propulsion Co., Sacramento, Calif. Advanced Technology Operations.
DETERMINATION OF PROCESSING AND TEST FACILITY REQUIREMENTS FOR LARGE SOLID ROCKET MOTORS. VOLUME 1: TASK 1 – FACILITY MODIFICATION FOR FULL-LENGTH 260 INCH DIAMETER MOTOR PROCESSING AND TEST Final Report
W. L. Lambert Aug. 1970 115 p refs
(Contract NAS3-12041)
(NASA-CR-72729) Avail: CFSTI CSCL 21H

A detailed processing plan, defining minimum-cost facility modifications and equipment requirements, was developed for the processing and static testing of a full-length 260-in. (6.6m)-dia solid rocket motor. For in-plant in-plant motor case movement, it was determined that a dock on an existing canal and a connecting roadway would be required. Process equipment and a temporary structure would be necessary for motor case insulation. Propellant processing would necessitate detailed premix dispensing and mixer improvements, and an expansion of oxidizer grinding capability. Propellant casting requirements include an adjustable multiple-tube

bayonet casting system and a new environmental shroud. Several structural support modifications in the cast-cure-test caisson would be required. Thrust vector side force measurement systems, increased instrumentation capability and support system additions also would be required at the test facility. Author

N70-36792*# Aerojet Solid Propulsion Co., Sacramento, Calif. Advanced Technology Operations.
DETERMINATION OF PROCESSING AND TEST FACILITY REQUIREMENTS FOR LARGE SOLID ROCKET MOTORS. VOLUME 2: TASK 2 – FACILITY OPTIMIZATION Final Report
W. L. Lambert Aug. 1970 129 p refs
(Contract NAS3-12041)
(NASA-CR-72751) Avail: CFSTI CSCL 21H

An overall processing plan, delineating optimum facilities and equipment requirements, was developed for the processing and static testing of full-length 260-in. (6.6 m)-dia solid rocket motors. Two program phases were considered: processing and static testing eight motors in 2.5 years, and processing, but not testing, 30 motors in 5 years. For the eight-motor program, an additional cast-cure-test facility would be required to meet the schedule. Motor case on-plant movement and case insulation would be accomplished in the manner previously defined for a single-motor program. Major expansion and improvements for propellant raw materials storage and handling are emphasized. A permanent and fully-equipped test facility installation would be provided in support of both cast-cure-test caissons. For the 30-motor program, the key factors were the logistics of motor case processing and efficient utilization of the two cast-cure-test caissons. Repetitive moves of the motor justified the placement of a new insulation facility between the receiving area and the casting facilities. Author

N70-36802* Kelsey-Hayes Co., Romulus, Mich.
VARIABLE THRUST ION ENGINE UTILIZING THERMALLY DECOMPOSABLE SOLID FUEL Patent
Ernest N. Petrick, inventor (to NASA) Issued 8 Dec. 1964 (Filed 12 Mar. 1963) 10 p Cl. 60-35.5 Sponsored by NASA
(NASA-Case-SMF-00923; UA-Patent-3,159,967;
US-Patent-Appl-SN-264736) Avail: US Patent Office CSCL 21C

A variable thrust ion engine is described which has a fuel feed system capable of instantaneous response to a command signal and repeated cycling through off-on operating states. Cesium vapor to provide propulsion to the engine is obtained by thermal decomposition of a solid cesium compound such as cesium hydride. R.B.

N70-36806* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ROCKET THRUST CHAMBER Patent
Edward F. Baehr, inventor (to NASA) Issued 23 Mar. 1965 (filed 13 Feb. 1962) 7 p Cl. 60-35.6
(NASA-Case-XLC-00145; US-Patent-3,174,279;
US-Patent-Appl-SN-173081) Avail: US Patent Office CSCL 21H

Large area-ratio nozzles for rocket motor thrust chambers are described. The nozzles are formed from a compound annular wall having radially spaced inner and outer surfaces formed from a group of elongated compound channel members located adjacent to each other. The outward extending ribs of the respective compound channel members are covered with a metallic girding which is wound about the exterior of the nozzle, throat, and combustion chamber portions to form the enclosed elongated channels. R.B.

N70-36817*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
S-4B-5 AUXILIARY PROPULSION SYSTEM 90-DAY RECYCLE CAPABILITY TEST REPORT, MODULE 3
Jun. 1969 165 p refs Revised
(Contract NAS7-101)
(NASA-CR-112369; DAC-56756A) Avail: CFSTI CSCL 21H

An evaluation is presented of the auxiliary propulsion system 90-day recycle capability test on module 3 that was conducted from 2 December 1968 to 25 February 1969. The test was conducted to verify the capability of the auxiliary propulsion system propellant tanks and helium pressurization line to withstand simulated flight vibrations and shock loads while loaded with propellants. Author

N70-36910* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LIQUID ROCKET SYSTEM Patent
Richard N. Porter, inventor (to NASA) Issued 23 Feb. 1965 (Filed 20 Jul. 1962) 4 p Cl. 60-35.6 Sponsored by NASA
(NASA-Case-XNP-00610; US-Patent-3,170,290;
US-Patent-Appl-SN-211464) Avail: US Patent Office CSCL 21H

Liquid rocket systems are described for propulsion and control of spacecraft. The fuel and oxidizer are contained in collapsible bladders located in a common pressure vessel, and the pressure vessel is subjected to a pressure fluid which acts equally on both bladders to expel the fuel and oxidizer simultaneously. The pressure fluid is generated by a monopropellant and a catalyst and the output pressure is modulated by a pressure regulator sensitive to the pressure exerted by one of the combustion constituents or by the pressurizing gas in the pressure vessel. A portion of the pressure fluid may be used to operate vernier or attitude control rockets or to drive a fluid motor for operating an electric power generator. R.B.

N70-36930*# TRW Systems Group, Redondo Beach, Calif.
ELECTROSTATIC PROPULSION BEAM DIVERGENCE EFFECTS ON SPACECRAFT SURFACES, VOLUME 1 Final Report
David F. Hall 17 Aug. 1970 121 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952350)
(NASA-CR-112872) Avail: CFSTI CSCL 21C

A program to develop understanding of and tolerance-level criteria for the deleterious effects of electrostatic rocket exhaust impinging on typical classes of spacecraft (S/C) surfaces is reported. Efforts included fabrication of necessary experimental fixtures and exploratory experiments. Fixture design, fabrication, and testing is reported along with experimental and analytical results obtained. Immersion at approximately 20 C of Teflon FEP and Kapton in liquid Cs, and of Pb/Sn solder in both Cs and Hg produced notable degradation of sample properties. Sylgard 182, Delrin, GT-100 and SMRD 745, which are representative of additional organic matrices found in S/C materials appeared unaffected by immersion in Hg and Cs. Silver reacted with Hg rather slowly. Ultimate tensile strength of Ag was unaffected by surface coatings of Hg and up to four weeks of reaction time. Addition of up to 10% Ag to soft solder apparently does not improve its resistance to Hg attack. Atomic Hg beams did not significantly affect the absorptivity or emittance of ten typical S/C coatings or the sputtering rate of aluminum under conditions where at most one monolayer of Hg could be absorbed. Author

N70-36951*# Defence Research Establishment Suffield, Ralston (Alberta).
A REVIEW OF DRES STUDIES ON THE EFFECT OF BLAST ON GAS TURBINE ENGINES
J. C. Muirhead May 1970 40 p refs
(DRES-267) Avail: CFSTI

Experiments in which an Orenda 8 gas turbine engine was subjected to blast waves are described. The inlet of the engine was loaded with blast waves of up to 13 psi overpressure. Only minor effects, such as small transient changes in engine speed and tailpipe temperature, were observed. The exhaust of the engine was

loaded with blast waves of up to 20 psi overpressure. At low engine speeds, blast pressures of about 10 psi were sufficient to cause compressor stall and combustion chamber flame-out. The exhaust bullet buckled under similar pressures while the engine was operating at high speeds. Author

N70-36964# Lockheed Missiles and Space Co., Palo Alto, Calif.
AFTEREFFECT IMPULSE OF LIQUID ROCKET ENGINES
V. A. Makhin et al. 1970 9 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Aviats. Tekh. (Kazan), no. 1, 1970 p 113–120
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The transient when a liquid rocket engine (LRE) is switched off is studied. The physical picture proceeding in the LRE after switch-off was commanded is analyzed, the fundamental components of the thrust aftereffect impulse of the LRE are determined, equations describing the engine switch-off process are derived, and methods for their solution are considered. Author

N70-37046*# IIT Research Inst., Chicago, Ill. Astro Sciences Center.
SOLAR ELECTRIC PROPULSION: A SURVEY TECHNOLOGY STATUS AND MISSION APPLICATIONS
A. L. Friedlander Mar. 1970 174 p refs Prepared for JPL
(Contract NAS7-100)
(NASA-CR-112773; M-21) Avail: CFSTI CSCL 21C

The solar electric propulsion (SEP) characteristics and capability for performing automated missions throughout the solar system are discussed. The terminology of parameters relevant to mission analysis are defined, and the mathematical interrelationship between trajectory, vehicle, and propulsion parameters is summarized. The current status of SEP hardward technology is described in terms of system parameter values such as specific mass and propulsion efficiency, and conceptual SEP spacecraft design studies are reviewed. Performance data on SEP mission applications are presented. Results of different studies are compared through the use of scaling laws, and SEP and ballistic performance for various mission classes are also compared. The motivation for developing performance scaling laws and the assumptions used are discussed, and the scaling formulas and numerical data on scaling accuracy are given. Abstracts of the survey articles and reports are included. Author

N70-37052*# TRW Systems, Redondo Beach, Calif.
ELECTROSTATIC PROPULSION BEAM DIVERGENCE EFFECTS ON SPACECRAFT SURFACES Quarterly Technical Report, 25 Apr. 24 Jul. 1970
15 Aug. 1970 12 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952350)
(NASA-CR-112871) Avail: CFSTI CSCL 21C

The third phase of a program to develop understanding of a tolerance-level criteria for the deleterious effects of electrostatic rocket exhaust (Cs, Cs(+), Hg, Hg(+)) impinging on typical classes of spacecraft surfaces is reported. This phase includes additional experiments and analysis leading to a modeling of contamination effects. Quartz crystal microbalance experiments showed that condensed mercury is removed very rapidly by incident energetic ions, probably through evaporation. The inertial loading of RTV silicone rubber coatings on the crystal are not proportional to their masses above minus 100 C. Author

N70-37245* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ION ROCKET Patent
Harold R. Kaufman, inventor (to NASA) Issued 10 Nov 1964 (filed 18 Sep. 1961) 7 p Cl. 60-35.5
(NASA-Case-XLE-00376; US-Patent-3,156,090; US-Patent-Appl-SN-139007) Avail: US Patent Office CSCL 21C

An electrostatic ion rocket engine utilizing electron bombardment is described. The propellant is vaporized in a boiler and enters the engine chamber where it is dispersed and then ionized by high velocity electrons emitted by a hot filament cathode. Magnetic coils around the engine cause the electrons to gyrate until they collide with atoms or other electrons. An accelerator grid maintained at a high negative potential accelerates the ions, and a screen grid in front of it directs the ions away from the accelerator grid to avoid destructive erosion. A neutralizer located downstream from the chamber emits electrons into the ion beam to neutralize the charge density and current of the beam. N.E.A.

N70-37394*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EARLY APPLICATION OF SOLAR ELECTRIC PROPULSION TO A 1-ASTRONOMICAL-UNIT OUT-OF-THE-ECLIPTIC MISSION
William C. Strack and Frank J. Hrach Washington Sep. 1970 23 p refs
(NASA-TN-D-5996; E-5703) Avail: CFSTI CSCL 21C

Current technology for solar electric propulsion is used to assess the potential performance advantages of low thrust propulsion for an out-of-the-ecliptic mission. Simple normal-to-the-orbit thrust steering is assumed with coast subarcs permitted. The electric spacecraft is launched onto an earth escape trajectory by an Atlas (SLV3C)-Centaur or a Titan 3C. Comparisons with a similarly launched uprated Burner 2 stage reveal that significant performance gains are possible using the electric stage with 250- to 475-day flight times. Author

N70-37522*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TRAJECTORY APPLICATION METHOD (TAM)
John P. Sheats 12 Sep. 1969 32 p refs
(NASA-TM-X-53900; MSFC-IN-1-67) Avail: CFSTI CSCL 21H

A simulation technique (TAM) for the post-flight evaluation of the propulsion system performance was developed which incorporates the time history trajectory parameters from the post-flight observed trajectory as input. This technique represents a significant reduction in time required to perform stage propulsion system evaluations. The development and some advantages and disadvantages of this technique are given. The propulsion system evaluation was performed on the S-1B stage of AS-201, AS-203, and AS-202 utilizing both the proposed technique and a conventional simulation technique; the results and comparison of both methods are presented. Additional detailed specifications of the TAM program are given in the appendices. Author

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N70-36315 National Lending Library for Science and Technology, Boston Spa (England).
SOME DATA ON THE EFFECT OF A TOWN'S ATMOSPHERE ON THE COMPONENTS OF THE RADIATION BALANCE
T. A. Golubova 9 Apr. 1970 9 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 248, 1969 p 63–68
(NLL-M-9057-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl. 1 NLL photocopy coupons

Data for Leningrad and Voyeykovo, taken from the Reference Book of the Climate of the USSR, were used to compare the components of the radiation balance and the duration of sunshine inside and outside cities. The amount of short-wave radiation and the radiation balance for Leningrad are calculated from data for observation times by the trapezium method, and for Voyeykovo were obtained from recording instruments. Corrections were made to the amounts calculated from values at observation times to allow for curvature of diurnal variations and to compare the radiation totals at the two stations. R.B.

N70-36335# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.

ON THE ORIGIN OF THE VAN ALLEN PROTONS Progress Report

G. Pizzella, G. Knorr, and B. A. Randall Mar. 1970 29 p refs (Contract N00014-68-A-0196-0003)

(AD-704178; U-OF-IOWA-70-10) Avail: CFSTI CSCL 4/1

The experimental data on protons trapped in the Van Allen belt obtained with the Injun 5 satellite are compared with a model recently proposed. The experimental data show a minimum in the energy spectrum which is predicted by the theory under the assumption that the wave energy be proportional to the plasma density. Furthermore, the experimental data for $2<L<6$ and for energies from 300 keV to 2 MeV can be described, as predicted, by a universal energy spectrum. The model also describes the experimental result of other authors that (E sub o) is approx. (L to the -3 power) at the equator, E sub o being the e-folding energy. Author (TAB)

N70-36339# Atomic Energy of Canada, Ltd., Chalk River (Ontario).

COSMIC RAY NM-64 NEUTRON MONITOR DATA CHACALTAYA, BOLIVIA. 3: JANUARY–DECEMBER 1969 [MONITOR DE NEUTRONES NM-64, CHACALTAYA, BOLIVIA. 3: ENERO-DICIEMBRE 1969]

R. Anda, (Univ. Mayor de San Andres), G. R. Mejia (Univ. Mayor de San Andres), and J. F. Steljes Jun. 1970 60 p in ENGLISH and SPANISH Sponsored in part by NSF and Univ. Mayor de San Andres

(AECL-3657) Avail: CFSTI; Atomic Energy of Can., Ltd., Chalk River: $1.50

Uncorrected and barometer corrected results from the cosmic ray station at Chacaltaya, Bolivia, are given in tabular form from January 1969 to December 1969. Normalized graphs of the neutron monitor and of the barometric pressure are also given. Author

N70-36509# National Taiwan Univ., Taipei. Dept. of Electrical Engineering.

OBSERVATION OF GEOSTATIONARY SYNCOM 3 Annual Report, Mar. 1968–Mar 1969

Kwang-Hong Pai Jul. 1969 17 p refs (Contract DA-CRD-AFE-S92-544-68-G)

(AD-698585; FE-401-2; AR-2) Avail: CFSTI CSCL 4/1

Total electron content and scintillation observations made at Taipei by receiving radio signal from Syncom III are examined. There exists post-sunset peak in electron content which has the greatest occurrence and largest peak value in March. The ratio of the electron contents for sunspot numbers 110 and 14 at this latitude is estimated to be about 3.4. The plasma temperature derived from the equivalent slab thickness of scale height for April varies from 850K at 00-02 hour to 1400K at 13:30 hour, and its daytime maximum lags 1.5 hours behind that of the solar radiation. The diurnal patterns of the scintillation occurrence for March, April and May differ considerably. It is possible that the difference can be attributed to the ionospheric irregularities situated at different heights. Author (TAB)

N70-36735*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

THE SPACE RADIATION ENVIRONMENT IN LOW ALTITUDE AND LOW INCLINATION ORBITS

M. O. Burrell and J. W. Watts, Jr. *In its* Opt. Telescope Technol. 1970 p 495–499 ref (See N70-36676 20-14)

Avail: CFSTI HC $10.00/MF $0.65 CSCL 03B

The charged particle dose rates expected for men and radiation sensitive materials such as photographic film in the low orbits of long-duration manned flights are discussed. The calculated dose rates are point doses for the center of a spherical aluminum shell whose thickness is given in g/sq cm units. Another geometrical factor considered in predicting the dose rate expected for men is the self-shielding provided by the body. Calculations are given for the combined dose rates expected for the aluminum shielding of the spacecraft and the self-shielding of the body. R.B.

N70-37010# European Space Research Organization, Paris (France).

REPORT PRESENTED TO THE THIRTEENTH COSPAR MEETING

1 Apr. 1970 109 p refs Conf. held at Leningrad, May 1970

Avail: CFSTI

This report summarizes the scientific results obtained with the ESRO 1, ESRO 2 and HEOS A1 satellites and the sounding rockets launched from Kiruna, Andoya (PCA campaign) and Sardinia. The experiments proposed for the HEOS A2, TD-1, ESRO 4, COS-B and GEOS satellites are also described. ESRO

N70-37170# Environmental Science Services Administration, Boulder, Colo. Research Labs.

CATALOGUE OF DATA ON SOLAR-TERRESTRIAL PHYSICS IN WORLD DATA CENTER A SUBCENTERS: SOLAR AND INTERPLANETARY PHENOMENA, IONOSPHERIC PHENOMENA, FLARE-ASSOCIATED EVENTS, GEOMAGNETIC PHENOMENA, AURORA, COSMIC RAYS AIRGLOW

Asheville, N.C. Jun. 1970 244 p refs Supported by NSF Supersedes N69-36441

(UAG-11) Avail: SOD $1.50

Data holdings at the subcenters of Upper Atmosphere Physics, Rockets and Satellites, and Geomagnetism are presented. Data samples and special information are given, and recommended standardized computerized formats are specified. N.E.N.

N70-37510*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

A METHOD FOR SIMULATING VAN ALLEN BELT PROTON ENERGY SPECTRA

John W. Watts, Jr. and Martin O. Burrell 16 Sep. 1969 18 p refs

(NASA-TM-X-53921; MSFC-IN-SSL-68-18) Avail: CFSTI CSCL 04A

To study radiation effects caused by geomagnetically trapped high energy protons, one must produce a proton source with the expected spectral characteristics. A method for generating such spectra using a spinning wheel of varying thickness is described. Resulting wheel shapes for two typical proton spectra are shown. Author

N70-37579# Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia).

ON THE POSSIBLE CAUSE OF SECULAR INCREASE OF PULSAR PERIODS

I. S. Shklovskii [1970] 3 p refs Transl. into ENGLISH from Astron. Tsirk. (USSR), no. 494, Feb. 1969 p 6–8

(CSIRO-Trans-9910) Avail: AEC Depository Libraries

Assuming rotating pulsars are moving in the galaxy at a very high speed, then due to the secular decrease of the radial component caused by the Doppler effect, there would always be an increase of rotation period, irrespective of the direction of pulsar movement. The galactic distribution of the pulsars now known is postulated as being a reason for their high speed. NSA

N70-37580# Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia).
SPECTRAL FLUX DENSITIES OF DISCRETE RADIO SOURCES AT 3.5 cm WAVELENGTH
A. E. Andrievskii et al [1970] 2 p Transl. into ENGLISH from Astron. Tsirk. (USSR), no. 494, Feb. 1969 p 1–3 In ENGLISH and RUSSIAN
(CSIRO-Trans-9912) Avail: AEC Depository Libraries

Measurements of radio-emission flux from 130 sources are tabulated. These were taken during Aug. –Sept. 1968 using the RT-22 dish (Crimea –Suneis). NSA

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N70-36289# California Univ., Los Angeles.
INVESTIGATION OF ECLIPSING BINARY SYSTEMS Final Report
Daniel M. Popper 20 Apr. 1970 6 p
(Contract Nonr-3507(00))
(AD-704612) Avail: CFSTI CSCL 3/2

The principal aim of the program has been to place the determination of stellar masses and radii, from analysis of eclipsing binary systems, on a sound observational basis. The approach has been analysis of spectrographic material, supplemented by results from light curves. The systems analyzed have included both those previously known to show the lines of both components - a necessary condition for mass determination - and those discovered in the program to have double lines. Author (TAB)

N70-36352# Joint Publications Research Service, Washington, D.C.
ASTRONOMY
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No. 233 29 Jul. 1970 p 1 4 (See N70-36351 20-34)
Avail: CFSTI

News briefs and abstracts of articles are presented on cosmic ray telescopes, the Zeeman effect in solar flares, a solar telescope in the Ukraine, and turbulence in the solar photosphere. R.B

N70-36356# Joint Publications Research Service, Washington, D.C.
UPPER ATMOSPHERE AND SPACE RESEARCH
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No 233 29 Jul. 1970 p 29–70 (See N70-36531 20-34)
Avail: CFSTI

News items are reported on the present and future of Soviet cosmonautics, the launching and flight activity of Cosmos and Meteor satellites and the Soyuz 9 spacecraft, the use of space systems to assist the fishing industry, and the contribution of the space program to astronomy. Articles are summarized on the parameters of the Es layer, determination of meteor declaration, ion composition of upper atmosphere at 130 to 155 km, auroral protons and the resonance concept of a substorm, mechanism of infrared radiation in the upper atmosphere, study of cosmic rays and the radiation belts, the aeronomy of the E and D regions, electric fields in the ionosphere and magnetosphere, disturbance of interplanetary plasma near Venus, high-energy electrons in circumterrestrial space, the effect of optokinetic and vestibular factors on human operators, the effect of solar eclipses on the E region of the ionospere, approximating functions for coupling coefficients for the neutron component, wind studies by the radiometer method, modeling of ionospheric scatter radio communication, effective electron collision frequency in the auroral ionosphere, and predicting foF2 by expansion into natural orthogonal components. R.B

N70-36388# Lincoln Lab., Mass. Inst. of Tech., Lexington.
OBSERVATIONS OF OH RADIO EMISSION SOURCES
John A. Ball 23 May 1969 104 p refs
(Contract AF 19(628)-5167)
(AD-704572; TR-458; ESD-TR-69-138) Avail: CFSTI CSCL 3/2

The 18-cm OH radio emission sources were studied to determine their character and their relation to other objects in our galaxy. The Haystack and Millstone antennas were used with a 100-channel digital autocorrelator to obtain Stokes parameter spectra of many of the brighter sources. Time variations in the OH emission from some of these sources were detected and studied and maps of the regions around OH emission sources were obtained in the continuum near 2 and 4 cm. The Haystack-Millstone spectral-line interferometer was used to check the positions of a pair of OH emission sources and to search for angular variation in the OH absorption across Cas A. Evidence for phenomenological associations between OH emission and H II regions, supernovae remnants, and infrared objects is discussed in the report and a kinematic model of the OH emission sources presented. Author (TAB)

N70-36490# Air Force Cambridge Research Labs., Bedford, Mass.
FORMATION DEPTHS OF ABSORPTION LINES IN THE SOLAR ATMOSPHERE
V. G. Buslavskiy Mar. 1970 18 p refs Transl. into ENGLISH from Akad. Nauk SSSR Krymsk. Astrofiz. Observ. Izv. (USSR), v.39, 1969 p 317–324
(AD-705044; AFCRL-70-0188; AFCRL-Trans-7021) Avail: CFSTI CSCL 3/2

Effective formation depths are determined for absorption lines in the solar atmosphere used for recording the magnetic field with the double magnetograph of the Crimean Astrophysical Observatory: wavelengths 4808, 5250, 5302, (Fel, 6103 (Cal) and 4554A (Ball). Author (TAB)

N70-36505# Rhode Island Univ., Kingston. Dept. of Electrical Engineering.
RESEARCH ON EXTREMELY LOW FREQUENCY PROPAGATION WITH PARTICULAR EMPHASIS ON SCHUMANN RESONANCE AND RELATED PHENOMENA, PART 1 Final Report, 15 Jan. 1965 –15 Nov. 1969
Anh Tran and Charles Polk 28 Feb. 1970 73 p refs
(Contract AF 19(628)-4950)
(AD-704564; Rept-4950/3-Pt-1; AFCRL-70-0143-Pt-1) Avail: CFSTI CSCL 4/1

Propagation characteristics of ELF waves in interplanetary space between the sun and the bow-shock of the magnetosphere are considered for parallel propagation. It is shown that only the right hand circularly polarized transverse wave and the longitudinal ion acoustic wave can propagate during normal quiescent conditions. However, damping is sufficiently high to make it unlikely that waves will be detected in the vicinity of the earth at any appreciable distance. For perpendicular propagation both ordinary and extraordinary modes are considered. Author (TAB)

N70-36516# Air Force Cambridge Research Labs., Bedford, Mass.
SOLAR ELEVATION, DEPRESSION AND AZIMUTH GRAPHS
Lawrence R. Doan and Brien P. Sandford Feb. 1970 298 p refs *Its* Environmental Res. Papers No. 313
(AD-705186 ; AFCRL-70-0086) Avail: CFSTI CSCL 3/1

Graphs are presented which allow the angle of elevation or depression and the true azimuth of the sun to be computed to within an accuracy of approximately 1 degree at any latitude and time of year. Alternately, the time at which the sun is at a given position can be computed within approximately 2 min. The graphs can also be used for planets and stars with declinations of less than 30 degrees. For the moon, significant errors will arise unless parallax corrections are applied. Author (TAB)

N70-36549*# National Aeronautics and Space Administration. Langely Research Center, Langely Station, Va.
PARAMETRIC DESIGN OF INTERPLANETARY AND ORBITAL TRAJECTORIES WITH EXAMPLES FOR MARS 1973, 1975, AND 1977 OPPORTUNITIES
John F. Newcomb and William F. Hampshire, II Washington Aug. 1970 79 p refs
(NASA-TN-D-5941; L-6564) Avail: CFSTI CSCL 22C

A method for parametrically studying the general interplanetary trajectory design problem is discussed; the method couples the design of interplanetary trajectories with the resulting planetary orbits obtainable from various launch and arrival opportunities. The procuedure is applied to the trajectories which could be launched to Mars in the years 1973, 1975, and 1977, and for those opportunities, a set of parametric charts for use in designing Mars missions is included. The important mission parameters are presented and discussed, and launch windows are established which maximize payload in planetary orbit for a coplanar periapsis deboost. Author

N70-36552# Aerospace Corp., El Segundo, Calif. Lab. Operations.
DESIGN DEVELOPMENT, AND INITIAL MEASUREMENTS OF A 1.4-MM RADIOMETRIC SYSTEM, REPORT AUGUST 1967 – AUGUST 1968
Walter A. Johnson, Tsutomu T. Mori, and Fred I. Shimabukuro 15 Feb. 1970 24 p refs
(Contract F04701-69-C-0066)
(AD-704584; TR-0066(5230-48)-1; SAMSO-TR-70-106) Avail: CFSTI CSCL 3/2

The development of a 1.4-mm heterodyne radiometric system and the initial measurements taken with it are described. The delta T of the system at the antenna terminals was approximately 18.6 K for a 0.25-Hz post-correlation noise bandwidth. Measurements show that the attenuation through the atmosphere at this wavelength is primarily due to water vapor, and an estimate of the zenith attenuation is given by A(dB) = 2.8 w, where w is the precipitable water in centimeters. Measurements of the antenna half-power beamwidths using the sun as a source show that at 1.4 mm, the atmospheric turbulence effects are not appreciable for observations through the atmosphere at zenith angles less than 45 deg with a 15-ft antenna. Author (TAB)

N70-36569*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APPLICATION OF BROUWER'S ARTIFICIAL-SATELLITE THEORY TO COMPUTATION OF THE STATE TRANSITION MATRIX
George H. Born and James C. Kirkpatrick Washington Aug. 1970 38 p refs
(NASA-TN-D-5934; MSC-S-242) Avail: CFSTI CSCL 22C

Brouwer's solution of the artificial-satellite problem without drag is used to obtain analytical state-transition-matrix expressions that include secular as well as long- and short-period effects of planetary oblateness. A comparison of the accuracy of several different models of the state transition matrix is made. These models include a Keplerian model, a model based on first- and second-order secular terms in Brouwer's theory, and a model including first- and second-order secular terms in addition to first-order long- and short-period perturbations. It is demonstrated that the accuracy of the Keplerian model degenerates rapidly in comparison to either of the models based on Brouwer's theory. In addition, it is shown with numerical results that including the effects of long- and short-period perturbations improves the accuracy of the transition matrix by one to two orders of magnitude over the secular model and three to four orders of magnitude over the Keplerian model. Author

N70-36655*# Arizona Univ., Tucson.
COMMUNICATIONS OF THE LUNAR AND PLANETARY LABORATORY. COMMUNICATIONS NUMBERS 142-148, VOLUME 8, PART 3
1970 82 p refs
(Grant NGL-03-002-002)
(NASA-CR-112357) Avail: CFSTI CSCL 03B

Research on planets, planetary satellites, comet orbits, and observatory sites for IR astronomy are reported. The comparative suitability of several U.S. mountain sites of observatories is discussed, based mainly on low water vapor content of the atmosphere. Details are given on Mt. Lemmon and Mt. Agassiz, Arizona; Pikes Peak, Colorado; Mt. Shasta, California; Mt. Rainier, Washington; and Mt. Logan, Canadian Yukon. Data on the planet Mercury is summarized, and problems that may be solved from image resolutions of about 1 km are mentioned. A map of Mars based on photographs taken with the Catalina Observatory telescope from 15 March to 20 May 1967 are presented. Relative measures of the satellites of Uranus and Mars taken with the McDonald Observatory reflector telescope and the Catalina Observatory telescope are tabulated. Orbital measurements and calculations were made for Comet Bester 1946k-1947I; Comet Burnham-Slaughter 1958e-1959I, and Comet Humason 1960e-1959X. N.E.N.

N70-36657# General Electric Co., Philadelphia, Pa. Missile and Space Div.
INTERPLANETARY EXPERIMENTS IN SPACE PHYSICS
J. B. Trice Jan. 1970 30 p refs
(DOC-70SD2) Avail: CFSTI

Several measurements within the domain of particles and fields that are appropriate for Mars-Venus Missions are discussed. The discussions are in terms of scientific relevance, relationship to other programs within the same discipline, weight, power, and general operational requirements. Solar wind measurements, magnetic field mapping, solar modulation of cosmic rays in interplanetary space and during planetary encounters, and particles and field measurements that uniquely relate to that planet's environment are included. The artificial comet experiment is conceived to study the physics of interaction between the solar wind and the comet. E.M.C.

N70-36677*# National Aeronautics and Space Administration, Washington, D.C.
NASA GOALS AND OBJECTIVES
Nancy Roman *In its* Opt. Telescope Technol. 1970 p 5–11
(See N70-36676 20-14)
Avail: CFSTI HC $10.00/MF $0.65 CSCL 03B

This general survey on NASA astronomical goals and objectives starts with the broad-based program of astronomical observations in space, emphasizes research in those wavelengths of the electromagnetic spectrum which do not penetrate the earth's atmosphere, and considers the development of specialized telescopes as well as satellites and multi-user laboratories to establish versatile, permanent, astronomical observatories in space. The goal is: (1) to

study energy distributions of celestial objects and to determine spatial and temporal distributions of celestial radiation sources of all wavelengths; (2) to determine fundamental characteristics of interstellar and intergalactic matter, fields, and their effects; (3) to develop structural and physical models of the quiet sun, processes involved in solar activity, and their effects on earth environment; and (4) to study important processes occuring on planets and other cool members of the solar system. G.G.

N70-36678*# Wisconsin Univ., Madison.
THE FUTURE OF PHOTOMETRY AND MODERATE RESOLUTION SPECTROPHOTOMETRY IN SPACE ASTRONOMY
Arthur D. Code *In* NASA, Washington Opt. Telescope Technol. 1970 p 13–15 (See N70-36676 20-14)
Avail: CFSTI HC $10.00/MF $0.65 CSCL 03B

Discussed are measurement methods on intensity, spectral distribution, and polarization in the optical and vacuum ultraviolet region of the spectrum and the kinds of scientific programs indicated for future observations in space astronomy. Measurements in the ultraviolet have been carried out for all classes of radiation sources and a summary of approximate stellar fluxes for stars of diverse types is presented. Anticipated are extensions of measurements to objects as faint as 25th magnitude, a factor of 10 to the 10th power fainter than presented flux data. Projected is also an 80-inch diameter telescope with one second-of-arc diaphragm that could carry out measurements on a 25th magnitude object with 45 minute exposure on sky background. G.G.

N70-36679*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
THE ROLE OF SURVEYS IN SPACE ASTRONOMY
Karl G. Henize *In its* Opt. Telescope Technol. 1970 p 17–24 (See N70-36676 20-14)
Avail: CFSTI HC $10.00/MF $0.65 CSCL 03B

Outlined are the following purposes of astronomical NASA surveys: (1) to provide reference date on stars and nebulae; (2) to furnish historical records of the changing cosmos; (3) to collect source data for statistical studies; and (4) to search for unusual stars and unexpected phenomena. Projected as most important is ultraviolet survey work as a means for searching for that small percentage of stars that may show anomalies in their ultraviolet radiation as well as for statistical and specific studies on sets of stars, and the use of photographic emulsion as detector. G.G.

N70-36680*# California Inst. of Tech., Pasadena.
INFRARED OBSERVATIONS IN SPACE ASTRONOMY
Gerry Neugebauer *In* NASA, Washington Opt. Telescope Technol. 1970 p 25–32 (See N70-36676 20-14)
Avail: CFSTI HC $10.00/MF $0.65 CSCL 03B

Depicted are various observational methods of infrared astronomy together with descriptions of photoconductive detectors and telescopes to be used from the earth's atmosphere. Results from observations with extended wavelengths to 3 20-micron windows established the presence of two types of infrared stars: (1) ordinary coolish stars with anomalously large infrared radiation at about 10 microns; and (2) objects that emit all of their radiation in the infrared with the bulk of their energies in the long wavelength region to 10 microns. Studies of infrared from extragalactic objects show that total energy emitted by the core of an ordinary galaxy is less by a factor of 100000 than that emitted by the Seyfer galaxy nucleus. G.G.

N70-36762# Eidgenossische Technische Hochschule, Zurich (Switzerland).
INTEGRATION THEORY OF KRYLOW-BOGOLIUBOW AND PERTURBED KEPLAR MOTION [INTEGRATIONSTHEORIE VON KRYLOW-BOGOLJUBOW UND GESTOERTE KEPLERBEWEGUNG]
Walter Flury (Ph.D. Thesis) 1969 75 p refs In GERMAN (Diss-4358) Avail: CFSTI

The asymptotic Krylow-Bogoliubow method is used to perform a perturbation calculation of the first order on the motion analysis of a multi-dimensional harmonic oscillator moving in the earth's gravitational field. The Legrende polynomial development of the earth potential is ended at the J sub 2 term and the motion of the body is described by a disturbed four dimensional harmonic oscillator with assumed time history. Solved is the Krylow-Bogoliubow differential equation for the position of the mobile body as a function of assumed time. This makes it possible to obtain highly accurate calculations on the shape and position of the disturbed orbit. Transl. by G.G.

N70-36869 National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APOLLO MISSION 11 PHOTOGRAPHY INDEXES
Oct. 1969 36 p Prepared by Aeron. Chart and Inform. Center (NASA-TM-X-65098) Avail: CFSTI CSCL 03B

Four Apollo 11 lunar photography index sheets are presented: (1) targets of opportunity, 70 mm, color; (2) targets of opportunity, 70 mm, black and white; (3) targets of opportunity, 70 mm, black and white; and (4) sequence photography, 16 mm, color. E.C.

N70-36870* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APOLLO MISSION 12 LUNAR PHOTOGRAPHY INDEXES
Mar. 1970 36 p Prepared by Aeron. Chart and Inform. Center (NASA-TM-X-65093) Avail: CFSTI CSCL 03B

Four Apollo 12 lunar photography index sheets are presented: (1) targets of opportunity, 70 mm, color and black and white; (2) targets of opportunity, 70 and 80 mm, black and white; (3) sequence photography, 16 mm, color; and (4) sequence photography, 16 mm, color and black and white. E.C.

N70-36879*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Space Sciences Div.
LUNAR AND PLANETARY SCIENCES.
In its Space Programs Sum. No. 37-62, Vol. 3 30 Apr. 1970 p 26–31 refs (See N70-36876 20-34)
Copyright. Avail: CFSTI CSCL 03B

Experiments in coloring synthetic lunar glass by titanium and iron are reported. Two possible causes of coloring are investigated: coloring due to electronic transitions in Ti(+3) ions and possibly Fe(+2), and coloring arising from absorption by colloid-size metallic spheres dispersed in the glass. The preparation of several synthethic glasses is described, and reflectance spectra were obtained. It is felt that the shift to longer wavelengths and the increased bandwidths indicate coloring effects expected from Ti(+3). Scattering calculations were made for spherical iron and ilmenite particles immersed in a hypothetical isotropic, glassy medium and in air. The extinction coefficient is greater in the blue than in the red, for spheres in glass than in air, and for iron than for ilmenite. N.E.N.

N70-36899*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Mission Analysis Div.
SYSTEMS ANALYSIS
In its Space Programs Sum. No. 37-62, Vol. 3 30 Apr. 1970 p 290–295 (See N70-36876 20-34)
Copyright. Avail: CFSTI CSCL 22A

The 1982 Jupiter Orbiter Mission is discussed in terms of matching the conic approach with the launch planet phase

consisting of the standard 100-nmi circular parking orbit. The interplanetary trajectory, and orbit selection are discussed, and a launch energy contour map is presented for the 1981 to 1982 launch opportunity. It is concluded that the 1982 mission is feasible.
F.O.S.

N70-36937*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
JET PROPULSION LABORATORY LUNAR STUDIES
15 Oct. 1969 23 p refs Sponsored by NASA
(NASA-CR-112685; JPL-760-43) Avail: CFSTI CSCL 22A

Advanced lunar studies are summarized to aid in FY 70 planning. The Advanced Lunar Study Team studies future lunar missions and provides consulting assistance to related lunar study efforts.
Author

N70-36980*# Utah Univ., Salt Lake City. Dept. of Mechanical Engineering.
SOLAR ELECTRIC GRAND TOUR MISSIONS TO THE OUTER PLANETS Final Report
G.A. Flandro Jun. 1970 91 p refs
(Grant NGR-45-003-050)
(NASA-CR-112778; UTEC-ME-70-033) Avail: CFSTI CSCL 22A

A combination of optimized solar electric low thrust propulsion and gravitational boost from intermediate planet hyperbolic encounters is applied to the purpose of achieving reasonable mission duration and payload mass. Optimum launch dates and performance parameters for Earth-Jupiter-Saturn-Pluto and Earth-Jupiter-Uranus-Neptune grand tour missions are obtained for Titan/Centaur and Atlas/Centaur launch systems with optimized solar electric final propulsive staging. Payload is increased over purely ballistic trajectories by more than three times. Use of the Titan 3X (1205)/Centaur permits two spacecraft of over 1000 kg (2200 lb) payload each to reach all planets of the outer solar system within a seven year period.
Author

N70-37001# Joint Publications Research Service, Washington, D.C.
SOVIET STUDIES ON SPACE TOPICS
6 Aug. 1970 19 p refs Transl. into ENGLISH from Zemlya Vselennaya (Moscow), no. 3, 1970 p 15–25
(JPRS-51107) Avail: CFSTI

CONTENTS:

1. SUCCESS RATE OF US PIONEER SATELLITES TRACED p 1–2 refs (See N70-37002 20-31)
2. STABILITY OF INTERSTELLAR C-13/C-12 RATIO WEIGHED p 3 ref (See N70-37003 20-30)
3. MAURITANIAN RIDGE COMPARED TO LUNAR PLAIN p 4–5 ref (See N70-37004 20-30)
4. GROWTH OF SPACE MEDICINE, BIOLOGY HIGHLIGHTED p 6–16 (See N70-37005 20-05)

N70-37003# Joint Publications Research Service, Washington, D.C.
STABILITY OF INTERSTELLAR C-13/C-12 RATIO WEIGHED
In its Soviet Studies on Space Topics 6 Aug. 1970 p 3 ref (See N70-37001 20-30)
Avail: CFSTI

The isotopic content, studied at Goddard Institute for Space Studies, was determined from absorption lines of C-13H(+) and C-12(+) molecules, and the interstellar C-12/C-13 ratio was found to be 82:1. Since the terrestrial ratio is 89:1 and the stellar ratio is 4:1, it is concluded that stars make a negligible contribution of carbon to interstellar space and that the composition of interstellar space is highly stable.
N.E.N.

N70-37004# Joint Publications Research Service, Washington, D.C.
MAURITANIAN RIDGE COMPARED TO LUNAR PLAIN
In its Soviet Studies on Space Topics 6 Aug. 1970 p 4–5 ref (See N70-37001 20-30)
Avail: CFSTI

Photographs taken on the Gemini 4 flight of Mauritania showed the similarity of the Rishat circular structure with Mare Orientalis, believed to have been formed by an asteroid collision. A geological expedition to Rishat was made in 1968 to study the possibility of a meteoritic-collision origin. No signs of a tremendous crash were found, and all basic features of the Rishat structure were explained by traditional geological processes.
N.E.N.

N70-37040# Atomic Energy Commission, Oak Ridge, Tenn. Div. of Technical Information Extension.
PULSARS: A BIBLIOGRAPHY
William D. Matheny May 1970 53 p refs
(TID-3320) Avail: CFSTI

This bibliography contains 442 abstracts of literature going back to 1957 from Nuclear Science Abstracts. NSA Vol. 24, number 6 was the cutoff for the current literature.
NSA

N70-37160# Rome Univ. (Italy). Scuola di Ingegneria Aerospaziale.
SOME PROPERTIES OF HELIOCENTRIC TRAJECTORIES OF NATURAL AND ARTIFICIAL SATELLITES OF THE SOLAR SYSTEM [ALCUNE PROPRIETA DELLE TRAIETTORIE ELIOCENTRICHE DEI SATELLITI NATURALI ED ARTIFICIALI DEL SISTEMA SOLARE]
Michele Sirinian Jan. 1970 38 p refs In ITALIAN; ENGLISH summary *Its* ATTI del Centro Ric. Aerospaziali No. 25
Avail: CFSTI

Different possible configurations of the heliocentric trajectories of natural and artificial satellites of the solar system are examined using some simplifying hypotheses. The possible trajectories are grouped into three separate classes, I, II, III. It is shown that class I trajectories are not possible for the first four planets of the solar system. Applying the results to the natural satellites, it is shown that only the moon travels along a class III trajectory.
Author (ESRO)

N70-37169*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ORBITAL RECONNAISSANCE PROGRAM FOR VIKING CLASS MISSIONS
Richard N. Green and Sue W. Souders Washington Sep. 1970 84 p refs
(NASA-TM-X-2070; L-7214) Avail: CFSTI CSCL 22A

A computer program was developed to meet the needs of Project Viking in the area of orbital reconnaissance. The program is presented as an analytical tool for preliminary mission design and analysis. The program has the capability of investigating the time history of both the spacecraft groundtrack and the camera footprint on the rotating surface of Mars. Various options are available to control where and how the photographs are taken. A sequence of photographs can be taken over a desirable lighting band, between two orbital true anomalies, or between latitudes of interest. Within the interval of desirable photography the photographs can be taken on either a time increment or a true anomaly increment. Also included is the option to take photographs on an overlap area consideration. Both vertical and nonvertical photography are available as program options. A description of the program input and output, a FORTRAN listing of the program, and samples of the input and output are included.
Author

N70-37226*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SCIENTIFIC APPLICATIONS OF RADIO AND RADAR TRACKING IN THE SPACE PROGRAM Conference Proceedings
L. Efron and C. B. Solloway, eds. 1 Jul. 1970 169 p refs Conf. held at Pasadena, Calif., 9-10 Apr. 1969
(Contract NAS7-100)
(NASA-CR-112344; JPL-TR-32-1475) Avail: CFSTI CSCL 03B

CONTENTS:

1. A BINARY CODED SEQUENTIAL ACQUISITION RANGING SYSTEM W. L. Martin p 3–13 refs (See N70-37227 20-07)

2. INVESTIGATIONS OF VERY LONG BASELINE INTERFEROMETRY AT SMITHSONIAN ASTROPHYSICAL OBSERVATORY R. D. Michelini (Smithsonian Astrophys. Obs.) p 15–26 refs (See N70-37228 20-07)

3. THE HAYSTACK PLANETARY RANGING RADAR J. V. Evans, R. P. Ingalls, and G. H. Pettengill (Lincoln Lab., Mass. Inst. of Tech.) p 27–36 refs (See N70-37229 20-07)

4. APPLICATION OF A MODEL FITTING PROCEDURE TO THE DETERMINATION OF UNKNOWN PARAMETERS IN SEVERAL THEORETICAL BACKSCATTER MODELS OF VENUS AT 70-cm WAVELENGTH R. F. Jurgens (Arecibo Ionospheric Obs.) p 43–49 refs (See N70-37230 20-07)

5. PARAMETER ESTIMATION FROM SETS OF TWO-DIMENSIONAL MAPS R. F. Jurgens (Arecibo Ionospheric Obs.) p 51–55 refs (See N70-37231 20-19)

6. THE POTENTIAL OF INTERPLANETARY SPACECRAFT DATA FOR TESTING GRAVITATIONAL THEORIES L. D. Friedman (Mass. Inst. of Tech., Cambridge) p 57–62 refs (See N70-37232 20-30)

7. RECONSTRUCTION OF JPL 1967 RANGE DATA FOR VENUS AND THE PROCESSING OF RADAR DATA D. A. O'Handley p 63–79 (See N70-37233 20-30)

8. SELECTED RESULTS FROM ANALYSIS OF RADAR AND OPTICAL OBSERVATIONS OF ICARUS AND THE INNER PLANETS W. B. Smith, I. I. Shapiro, M. E. Ash, G. H. Pettengill, and R. P. Ingalls (Lincoln Lab., Mass. Inst. of Tech.) p 85–90 refs (See N70-37234 20-30)

9. REMARKS ON THE INFERENCE OF NEUTRAL ATMOSPHERIC PARAMETERS FROM MICROWAVE OCCULTATION DATA F. F. Fishbach (Michigan Univ., Ann Arbor) p 99–103 refs (See N70-37235 20-30)

10. PROFILE INVERSION PROCESSING OF RADIO OCCULTATION DATA FOR THE DETERMINATION OF PLANETARY ATMOSPHERES I. Shear, R. R. Bravoco, P. E. Langevin, and M. D. Grossi (Raytheon Co., Sudbury, Mass.) p 105–114 refs (See N70-37236 20-30)

11. INVERTING RADIO OCCULTATION DATA USING EMPIRICAL ORTHOGONAL FUNCTIONS B. Lusignan (Stanford Univ.) p 115–117 (See N70-37237 20-30)

12. SOME CHARACTERISTICS OF THE SOLAR ATMOSPHERE THAT MAY BE INVESTIGATED BY A VHF ANTENNA SYSTEM J. C. James (Mass. Inst. of Tech., Cambridge) p 119–126 refs (See N70-37238 20-30)

13. RADAR STUDIES OF VENUS AT 3.8-cm WAVELENGTH J. V. Evans, T. Hagfors, R. P. Ingalls, D. Karp, W. E. Morrow et al (Lincoln Lab., Mass. Inst. of Tech.) p 127–144 refs (See N70-37239 20-30)

14. RADAR MEASUREMENTS OF LUNAR SURFACE ROUGHNESS A. Shapiro, E. A. Uliana, and B. S. Yaplee (Naval Res. Lab., Wash., D.C.) p 145–159 refs (See N70-37240 20-30)

N70-37232*# Massachusetts Inst. of Tech., Cambridge. Measurement Systems Lab.
THE POTENTIAL OF INTERPLANETARY SPACECRAFT DATA FOR TESTING GRAVITATIONAL THEORIES
L. D. Friedman *In* JPL Sci. Appl. of Radio and Radar Tracking in the Space Program 1 Jul. 1970 p 57–62 refs (See N70-37226 20-30)
(Grant NGR-22-009-386)
Avail: CFSTI CSCL 03B

The description of the solar system forces affecting the motions and observations of interplanetary spacecraft is discussed for purposes of examining the potential of using the observations of such spacecraft to test gravitational theories. The use of the data depends not only on the inherent quality of the measurement, but also the limitations of the model. The investigation of gravitational and nongravitational forces reveals the limiting factors on the test and the requirements of the modeling. Inadequate understanding of the low thrust forces is discussed. By consideration of the Mariner 4 mission and other interplanetary missions, progress in the investigation of the potential of estimating the critical parameters of gravitational theories is discussed. Author

N70-37233*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RECONSTRUCTION OF JPL 1967 RANGE DATA FOR VENUS AND THE PROCESSING OF RADAR DATA
D. A. O'Handley *In its* Sci. Appl. of Radio and Radar Tracking in the Space Program 1 Jul. 1970 p 63–79 (See N70-37226 20-30)
Avail: CFSTI CSCL 03B

Planetary range data on Venus were obtained in 1967 at the Goldstone tracking station. The range value was constructed through combining the measured residual with the computed range. These range data together with similar data were used in the development of a simultaneous integration of all the planets over 20 years. Upon the extension of this ephemeris to 60 years, and an increased radar and optical data set, an anomaly has appeared in the residuals. A discussion of the time base and results are given. Author

N70-37234*# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SELECTED RESULTS FROM ANALYSIS OF RADAR AND OPTICAL OBSERVATIONS OF ICARUS AND THE INNER PLANETS
W. B. Smith, I. I. Shapiro, M. E. Ash, G. H. Pettengill, and R. P. Ingalls *In* JPL Sci. Appl. of Radio and Radar Tracking in the Space Program 1 Jul. 1970 p 85–90 refs Sponsored by AF (See N70-37226 20-30)
Avail: CFSTI CSCL 03B

Results were obtained from analysis of optical data of the sun and Icarus, and radar and optical data of Venus and Mercury, by the addition of 1968 planetary radar data and Icarus optical data taken near its close approach in 1968. Assuming the contribution of the solar gravitational quadrupole moment to be negligible, we find that the general relativistic perihelion advance of Mercury is confirmed within a (formal) standard error of 1.5%, and the relativistic retardataion of radar waves near the sun wihin a (formal) standard error of 6%. In addition to these parameters, which test the underlying physical laws, new estimates have been obtained for the radii of Mercury and Venus, the AU, the mass of Mercury, and the earth-moon mass ratio. Also, the radar data weakly indicate that the Venus equator may not quite be circular, being out-of-round by about 1.2 (+ or − 0.4) km, and that its equatorial center-of-figure may be offset from its center-of-mass by about 0.8 (+ or − 0.2) km. Mercury exhibits neither effect within the formal uncertainty of about 0.5 km. Author

N70-37235*# Michigan Univ., Ann Arbor. Dept. of Aerospace Engineering
REMARKS ON THE INFERENCE OF NEUTRAL ATMOSPHERIC PARAMETERS FROM MICROWAVE DATA
Frederick F. Fishbach *In* JPL Sci. Appl. of Radio and Radar Tracking in the Space Program 1 Jul. 1970 p 99–103 refs (See N70-37226 20-30)
Avail: CFSTI CSCL 03B

The phase shift theory as presented by analysis of Mariner 4 data is reviewed. The approximations made in deducing the neutral atmosphere of Mars by four methods are considered in the context of their potential application to a system for measuring the earth atmosphere. A preferred inversion technique is suggested. The assumption of spherical stratification on earth is also discussed. Author

N70-37236*# Raytheon Co., Sudbury, Mass.
PROFILE INVERSION PROCESSING OF RADIO OCCULTATION DATA FOR THE DETERMINATION OF PLANETARY ATMOSPHERES
I. Shear, R. R. Bravoco, P. E. Langevin, and M. D. Grossi *In* JPL Sci. Appl. of Radio and Radar Tracking in the Space Program 1 Jul. 1970 p 105–114 refs (See N70-37226 20-30)
(Contract NASw-1772)
Avail: CFSTI CSCL 03B

A comparative study is presented of various data processing methods applicable to the doppler residuals obtained from radio occultation experiments. The aim of the processing is to construct radial refractivity profiles of a planet's atmosphere and ionosphere along several verticals distributed around the planet. Some of the techniques are methods which use the Abel transform, the model matching, the Herglotz-Wiechert and the Gerver-Markushevich approaches. Emphasis is placed on the problem areas of implementing these methods on a high-speed digital computer, on the possible solutions, and on the evaluation of the computer execution time. An initial analysis is also provided of the expected accuracies of these methods. A brief description of the Hamiltonian ray-tracing program used is also presented. Author

N70-37237*# Stanford Univ., Calif. Center for Radio Astronomy.
INVERTING RADIO OCCULTATION DATA USING EMPIRICAL ORTHOGONAL FUNCTIONS
Bruce Lusignan *In* JPL Sci. Appl. of Radio and Radar Tracking in the Space Program 1 Jul. 1970 p 115–117 (See N70-37226 20-30)
Avail: CFSTI CSCL 03B

A method of describing the atmosphere by means of radio occultation data inversion is presented. Author

N70-37238*# Massachusetts Inst. of Tech., Cambridge. Solar Radar Station.
SOME CHARACTERISTICS OF THE SOLAR ATMOSPHERE THAT MAY BE INVESTIGATED BY A VHF ANTENNA SYSTEM
Jesse C. James *In* JPL Sci. Appl. on Radio and Radar Tracking in the Space Program 1 Jul. 1970 p 119–126 refs (See N70-37226 20-30)
Avail: CFSTI

A series of experiments to furnish information about the sun's corona by means of an earth-based facility is outlined. These experiments are an economical way to obtain a better understanding of the properties of the solar corona to 1 AU. The particular facility considered is the proposed Sunblazer antenna array, which will operate in the frequency range of 70 to 80 MHz and will transmit 1 MW of power. The experiments include a radar study of the sun at 75 MHz and a study of interplanetary plasma by using planets as reflectors of radio energy transmitted from the earth. Radar studies of the sun and all planets out to Saturn will be possible. Results with the 38-MHz El Campo solar radar system are presented to emphasize the need for radar studies at 75 MHz. In particular, radar studies at 75 MHz should lead to a knowledge of the velocity and intensity of compressional waves that heat the corona. Radar waves at this frequency should penetrate the corona to the level of 1.15 solar radii. Author

N70-37239*# Lincoln Lab., Mass. Inst. of Tech., Lexington.
RADAR STUDIES OF VENUS AT 3.8-cm WAVELENGTH
J. V. Evans, T. Hagfors, R. P. Ingalls, D. Karp, W. E. Morrow et al *In* JPL Sci. Appl. of Radio and Radar Tracking in the Space Program 1 Jul. 1970 p 127–144 refs Supported by AF (See N70-37226 20-30)
Avail: CFSTI CSCL 03B

Studies of the reflection properties of Venus at 3.8-cm wavelength are summarized. The scattering properties of the planet were examined extensively, and it was determined that the surface of Venus is significantly smoother than that of the moon. By comparing the radar brightness distribution over the planetary disk with observations at longer wavelengths, it was established that the limbs are darker at 3.8-cm than would be expected. This effect is attributed to greater atmospheric absorption of those rays that traverse the atmosphere obliquely. E.M.C.

N70-37240*# Naval Research Lab., Washington, D. C. Hulbert (E. O.) Center for Space Research.
RADAR MEASUREMENTS OF LUNAR SURFACE ROUGHNESS
Allan Shapiro, E. A. Uliana, and B. S. Yaplee *In* JPL Sci. Appl. of Radio and Radar Tracking in the Space Program 1 Jul. 1970 p 145-159 (See N70-37226 20-30) refs
Avail: CFSTI CSCL 03B

Direct topographic information about planetary surfaces is obtained from radar measurements if the transmitted pulse is sufficiently narrow to resolve the surface structure. The height distribution of the reflecting areas in the observed region can be derived from the shape of the radar echo rise time. The high-range resolution lunar echoes are presented to illustrate the effect of surface topography on the shape and structure of the early part of the radar echo. Earth-based radar observations of planetary surfaces are limited by restricted coverage and sensitivity requirements. These limitations can be overcome by utilizing radar observations from planetary orbiters with high inclination. In particular, observations from an orbiting radar around Venus would probably provide the only direct information about the planet surface topography. Author

N70-37375# Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia).
PULSAR IN CRAB NEBULA AS A POSSIBLE SOURCE OF GRAVITATIONAL RADIATION
I. S. Shklovskii [1970] 4 p refs Transl. into ENGLISH from Astron. Tsirk. (USSR), no. 494, Feb. 1969 p 4–6 In ENGLISH and RUSSIAN
(CSIRO-Trans-9909) Avail: AEC Depository Libraries

The explanation of secular drag of the pulse of NP 0532 is postulated in terms of the comparatively low equatorial rotation speed. The change of shape to triaxial ellipsoid, on the brink of fragmentation, is also thought to be sufficient for the establishment of powerful gravitational radiation. NSA

N70-37380# Woods Hole Oceanographic Institution, Mass.
GEOPHYSICAL FLUID DYNAMICS. VOLUME 1: COURSE LECTURES AND ABSTRACTS OF SEMINARS
Nov. 1969 141 p refs
(Grant NSF GZ-419)
(PB-189618; WHOI-Ref-69-41-Vol-1) CSCL CFSTI CSCL 03B

Contents: Perturbation theory; A scaling and expansion of equations of motion to yield the Boussinesq equations; Self-gravitating stellar systems; Structure of barred spirals; Machine simulation of galactic evolution; Fluid dynamical phenomena in the sun; Decrease in the rotation rate of the sun; Waves in galactic disks; Worlds in collision (almost); Tidal effects in double stars; Geophysical inverse problems; The optimal structure of turbulent transport processes; Differential rotation in stellar convection zones; An approach to thermal convection; Baryon inhomogeneity in the early universe; Report on the boeing turbulence symposium;

Convergents to turbulence functions; The generation of longshore currents; On multivariable asymptotic expansions; Acoustic waves in rapidly varying inhomogeneous fluids; Time-dependent cellular convection; Magnetic braking and the oblique rotator model. USGRDR

N70-37381# Woods Hole Oceanographic Institution, Mass.
GEOPHYSICAL FLUID DYNAMICS. VOLUME 2: FELLOWSHIP LECTURES
Nov. 1969 174 p refs
(Grant NSF GZ-419)
(PB-189619; WHOI-Ref-69-41-Vol-2) Avail: CFSTI CSCL 03B

Contents: Overstable damping in a stellar semiconvective zone; Periodic motions in a spherical shell; Penetrative convection in a rotating fluid; Instability of the solar chromosphere; Violent transition in a rotationally-constrained fluid; Waves in a rotating, stratified fluid of variable depth; Electromagnetic torques on interstellar clouds; Thermodynamic and statistical aspects of non-isotropic convection; Gas flow around a star. USGRDR

N70-37396*# Analytical Mechanics Associates, Inc., Lanham, Md.
SOLAR ELECTRIC INTERPLANETARY TRAJECTORY AND PERFORMANCE DATA FOR SUB-OPTIMAL POWERED SPACECRAFT
J. L. Horsewood and F. I. Mann Apr. 1970 324 p ref
(Contract NAS5-11193)
(NASA-CR-112840) Avail: CFSTI CSCL 22C

A comprehensive collection of trajectory and spacecraft data are presented for unmanned interplanetary missions using suboptimally powered solar electric propulsion. Data are presented for flyby and orbiter missions from Earth to Venus, Mars, Ceres, Jupiter, Saturn, Uranus, and Neptune and for flyby missions to Mercury. The planets are assumed to be in circular, coplanar orbits. For each mission, both direct and indirect flight modes are represented, and fully optimized (except for power) trajectory data are given for missions using the two launch vehicles Titan-3 X(1205)/Centaur and Titan 3 C. A constant jet exhaust speed solar electric propulsion system having a specific mass of 30 kg/kw is optimized in terms of jet exhaust speed to yield maximum net spacecraft mass. The hyperbolic excess speeds at departure and arrival and the heliocentric travel angle are optimized for each mission. For orbiter missions, a chemical retro stage is used to brake the spacecraft into a highly eccentric capture orbit about the target planet. Author

N70-37401*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE EFFECTS OF TRACKING STATION POSITION UNCERTAINTIES ON ORBIT DETERMINATION FOR THE GEOS-1 SATELLITE
J. G. Marsh and R. W. Agreen May 1970 52 p refs
(NASA-TM-X-65312; X-552-70-195) Avail: CFSTI CSCL 22C

A study was made to determine the effect of tracking station location errors on the computed position of the GEOS-1 satellite and on the fits of the data to the orbit. This was done by selecting a standard set of precision reduced optical data from a global set of stations and determining a reference orbit and a reference prediction ephemeris of the same length as the definitive orbit (4 days). Then errors of 30 and 60 meters were introduced into the positions of various station subgroups and both the definitive orbit and prediction ephemeris were recomputed. The rms value of satellite position differences in the definitive period corresponding to a 30 meter station error in either latitude or longitude ranged from 2.4 to 13.6 meters. During the predictin period satellite position differences for a 30 meter station error ranged from rms values of 2.3 to 20.2 meters. Differences in the orbital positions and in the data fits are presented in tabular and graphical form. Author

N70-37415*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PROPOSED GRAVITY-GRADIENT DYNAMICS EXPERIMENTS USING THE RAE-1 SPACECRAFT
David L. Blanchard and Harvey Walden Jul. 1970 27 p refs
(NASA-TM-X-65318; X-552-70-296) Avail: CFSTI CSCL 22C

It is believed that none of the experiments will impair the spacecraft structure or adversely affect the continuance of the scientific mission of the satellite following completion of the proposed experiments. Two experiments involve clamping the libration damper mechanism, once when the orbits are in full sunlight and once when each orbit is partially occulted. Observations will then record any librational disturbances to the steady-state condition. The other four experiments involve retracting or extending one boom or a pair of booms from the lower Vee antenna, both with the damper clamped and unclamped. By the law of conservation of angular momentum, changes in the lengths of the primary booms (which are currently fully deployed at 750-foot lengths) will induce angular librations of the spacecraft. Data from these experiments will provide information relating to damper effectiveness (especially at large amplitude attitude motions), the dynamics of particular asymmetrical spacecraft configurations, the boom structural damping, the spacecraft dynamics in the absence of a damper, and the effects of partial solar occultation with the damper clamped. Author

N70-37439*# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
MANEUVERING THE DUAL MODE MANNED/AUTOMATED LUNAR ROVING VEHICLE, JUNE 1969 – MARCH 1970
Walter F. Wood and Gregory M. Lewandowski 23 Mar. 1970 80 p refs
(Contract NAS8-25110)
(NASA-CR-102823; CAL-VS-2860-D) Avail: CFSTI CSCL 22A

Digital maps of hazards to movement for the dual mode Lunar Roving Vehicle are presented. The area mapped from vertical orbiter photography and astronauts geologic maps is located in Sinus Medii. Hazards to movement located within grid squares 50 meters on a side were transformed into digital data for computer access. Maps produced by computer were prepared showing these hazards. Author

N70-37444*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LUNAR GRAVITY MODELS FOR IMPROVED APOLLO ORBIT COMPUTATION
James P. Murphy, Theodore L. Felsentreger, Carl A. Wagner, and James W. Ryan Jul. 1970 59 p refs Submitted for publication
(NASA-TM-X-65317; X-552-70-289) Avail: CFSTI CSCL 22C

Three possible modifications of the operational lunar gravity model for Apollo missions are presented. One of these is recommended for use in future Apollo missions. This field, designated ML1.1, consists of the current operational model (L1) plus the following values for the (4,1) harmonics: C sub 41 = .00001284 and S sub 41 = .00001590. The main benefit to be derived from the use of this model lies in its capability to predict the inclination and inertial node for all the Apollo orbits accurately. The current L1 model fails to do this, especially for the low inclination cases. The (4,1) values were obtained by considering classical elements from Apollos 8, 10, 11, and 12 as observables in a least squares gravity retrieval program. The ML1.1 model performed as well or better than did the L1 field in predicting the trajectories for Apollo and Lunar Orbiter spacecraft. The tracking data were fit just as well, also. The desirable properties of the L1 model are all preserved with the ML1.1 model. Author

N70-37462*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE MAGNETIC FIELD OF THE SUN AND THE GENERATION

OF SUNSPOTS
Klaus Schocken 16 Sep. 1969 16 p refs
(NASA-TM-X-53933; MSFC-R-SSL-INT-67-13) Avail: CFSTI CSCL 03B

Migratory dynamo waves in a prismatic volume of a conducting fluid, as it exists in the solar convective zone, are constructed. Such waves can explain the principal features of the observed solar magnetic activity, particularly the sunspots. Author

N70-37479# McDonnell-Douglas Co., Santa Monica, Calif.
THE McDONNELL-DOUGLAS GEOPHYSICAL OBSERVATORY PROGRAM Progress Report
J. M. Mc Donough Nov. 1969 38 p refs Supported in part by NSF
(PB-188877; MDCG-1193; PR-8) Avail: CFSTI CSCL 03A

Contents: The MDAC-WD geophysical observatory program; (The artic observatory, the antarctic observatory); Data reduction; Solar cosmic ray event analysis; Magnetospheric studies. USGRDR

N70-37493*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TRACKING ACCURACY STUDIES OF GEOS-C ORBITS FOR ALTIMETRY USING RADAR AND OPTICAL DATA
J. G. Marsh and B. C. Douglas Feb. 1970 21 p refs
(NASA-TM-X-65310; X-552-70-136) Avail: CFSTI CSCL 22C

Tracking accuracy studies of orbits of the type envisioned for GEOS-C indicate that gravity model and station position uncertainties preclude determination of spacecraft altitude within 10-20 meters. However, the variation of height error is low (1 meter in 20-30 minutes) with intensive tracking so surveys of relative changes in sea level over short arcs appear feasible. The low inclination of 20 deg for GEOS-C appears to incur little or no penalty in orbit determination accuracy, particularly if SAO Baker-Nunn or unified S-band tracking is used. In spite of limited coverage by STADAN optical stations, such data will be an important supplement to previous GEOS analyses. Author

N70-37505*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
STAGED CONVOY CONCEPTS IN LUNAR AND PLANETARY SURFACE EXPLORATION
Georg von Tiesenhausen 26 Sep. 1969 15 p
(NASA-TM-X-53946; MSFC-IN-ASO-67-4) Avail: CFSTI CSCL 22A

Staging concepts for surface explorations are described which utilize en route supply transfers between vehicles or travelers and the establishment of depots. Range increases of over 60 to 100% can be accomplished. An analysis of optimum stage distances and depot sizes and their spacings is given. A few examples of applications are provided. Author

N70-37507*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ALTERNATE APOLLO MISSIONS: LIBRATION POINTS
John T. Wheeler 12 Sep. 1969 24 p refs
(NASA-TM-X-53901; MSFC-IN-AERO-2-67) Avail: CFSTI CSCL 22C

This note discusses the possible application of the Saturn-type vehicles to libration-point missions alternate to the basic design Apollo lunar landing mission. Situated in the earth-moon system are the five libration points at which the third body (space vehicle) will remain stationary relative to the two primary bodies. At least four criteria, namely, velocities in vicinity of libration points, stability of motion, equations of motion, and scientific applications are reviewed. Author

N70-37521*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
IMPULSIVE VELOCITY REQUIREMENTS FOR INSERTION INTO ORBITS ABOUT VENUS, MARS, AND JUPITER
Richard Gold 12 Sep. 1969 129 p refs
(NASA-TM-X-53904; MSFC-IN-AERO-68-3) Avail: CFSTI CSCL 22C

The tangential impulsive coplanar transfer between a planetary approach hyperbolic trajectory and a planetocentric capture orbit of a desired size and orientation is studied for Venus, Mars, and Jupiter. The parameters considered are rotation angle, periapsis radius, apsidal ratio of the capture orbit, and hyperbolic approach velocity. The experimental results will serve as an aid to mission analysts and spacecraft designers in the area of preliminary design. The method used in computing the impulsive velocity requirements is presented in the appendix. Author

N70-37545*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ON ANALYSIS OF AREA COVERAGE BY ORBITAL PHOTOIMAGING SYSTEMS
G. R. Woodcock 26 Sep. 1969 67 p refs
(NASA-TM-X-53948; MSFC-IN-ASO-68-1) Avail: CFSTI CSCL 22A

Initial steps taken toward developing an automated analysis of planetary surface area-coverage provided by an orbital photoimaging system from the baseline orbit are reported. It is intended to facilitate mission design for a planetary orbiter, such as the previously proposed Voyager 1973 Mars mission which has since been deleted from planning. Author

N70-37546*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
COMPARISON OF EXPERIMENTAL AND THEORETICAL BRIGHTNESS TEMPERATURES OF THE LUNAR SURFACE FOR DIFFERENT ELEVATION ANGLES OF SUN AND OBSERVER
James K. Harrison 16 Sep. 1969 19 p refs
(NASA-TM-X-53931; MSFC-R-SSL-INT-67-11) Avail: CFSTI CSCL 03B

A semi-empirical mathematical expression was developed for predicting the surface infrared radiation from a local area of the moon as a function of sun position and angle of observation. The brightness temperatures calculated by using this expression are compared with the experimental data given. Author

N70-37562*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ON THE REAL SINGULARITIES OF THE N-BODY PROBLEM
Hans J. Sperling 12 Sep. 1969 102 p refs
(NASA-TM-X-53905; MSFC-IN-AERO-68-6) Avail: CFSTI CSCL 30A

A collision singularity in the n-body problem has the property that all position vectors have finite limits and at least one mutual distance approaches zero as time approaches the instant of the singularity. General properties of a collision singularity are investigated and it is found that they are analogous to those of a collision of all bodies at the same point and time. A more detailed study of a simple type of such a singularity, namely that of several simultaneous binary collisions, is presented. Author

N70-37563*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE THERMAL STRUCTURE OF THE SUN
Klaus Schocken 16 Sep. 1969 21 p refs
(NASA-TM-X-53925; MSFC-R-RP-INT-67-3) Avail: CFSTI CSCL 03B

Under the assumption of radiative equilibrium in the core, of convective equilibrium in the outer parts of the envelope, and of a pronounced inhomogeneity in composition, models of the interior of the sun are derived. As sources of energy, the proton-proton reaction and the carbon-nitrogen cycle are considered. The derivation of sun models is carried through in three steps. First, a homogeneous model is determined for the initial state of the sun, when the hydrogen reaction is just beginning. Second, on the basis of this initial model, the transmutation rates and the present composition are computed for every point in the sun. Finally, using this inhomogeneous composition, a model for the sun in its present state is constructed. Author

N70-37569*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SYMMETRIC ROUND TRIP FLYBYS TO OUTER PLANETS
G. R. Woodcock 26 Sep. 1969 34 p refs
(NASA-TM-X-53947; MSFC-IN-ASO-67-6) Avail: CFSTI CSCL 22C

An exploratory analysis was performed to determine the feasibility of outer planet, round-trip mission profiles which might have manned flight applications. Simplifying assumptions used minimized the analytical effort, but the main conclusions are still considered valid. A round-trip flyby of Jupiter of approximately 1000 days duration was found, which appears to be within the capabilities of technology generally assumed for a manned Mars stopover mission. Missions beyond Jupiter were found to be either of very long duration or very demanding in terms of propulsion requirements. Multiplanet flybys were not examined, but it is suggested that, at least in the case of Jupiter-Saturn-and-return flyby, energy requirements might be less than for the Saturn-only case. Author

N70-37599# Manchester Univ. (England). Dept. of Astronomy.
PHOTOGRAPHIC AND SPECTROGRAPHIC OBSERVATIONS OF THE MOON AT PIC-du-MIDI Final Scientific Report, 15 Feb. 1965 – 14 May 1969
Zdenek Kopal Jan. 1970 184 p refs
(Contract AF 61(052)-882)
(AD-706122; AFCRL-70-0205) Avail: CFSTI CSCL 03/2

The present report contains an account of the work carried out between 1965-1969 in the following fields of research: (1) the design and development of a new type of image-scanning three-beam photoelectric photometer for observations of transient colour changes on the lunar surface; (2) three-colour photoelectric photometry of the Moon, carried out with the new instrument between 1966-1968; (3) multicolour photoelectric observations of the lunar surface, with special respect to the colour-dependence of the opposition effect; (4) single-colour photographic photometry of the Moon, leading to an investigation of the light scattering properties of the lunar surface; and (5) investigation of a possible correlation of lunar luminescence with the planetary magnetic index. Author (TAB)

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N70-36367# Joint Publications Research Service, Washington, D.C.
SUPPLEMENT
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No. 223 29 Jul. 1970 p 71 – 81 (See N70-36351 20-34)
Avail: CFSTI

The contributions of the Soyuz 9 flight to space research and the problems encountered during the flight are examined. The medical and biological effects weightlessness and prolonged space flight on the human organism are discussed. R.B.

N70-36379*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACE PROGRAMS SUMMARY NO. 37-63, VOLUME 1 FOR THE PERIOD 1 MARCH – 30 APRIL 1970. FLIGHT PROJECTS
31 May 1970 73 p
(Contract NAS7-100)
(NASA-CR-112336; JPL-SPS-37-63-Vol-1) Copyright. Avail: CFSTI CSCL 22B

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1. MARINER MARS 1971 PROJECT p 1 – 38 (See N70-36380 20-31)
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N70-36380*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MARINER MARS 1971 PROJECT
In its Space Programs Sum. No. 37-63, Vol. 1 31 May 1970 p 1 – 38 (See N70-36379 20-31)
Copyright. Avail: CFSTI CSCL 22B

The subsystems, project objectives, and status of the two-spacecraft 1971 mission are discussed. The mission and test computer system and mission operations software system are described, and their responsibilities are indicated. Activities are reviewed for solar panel-battery power analysis, scan platform motion effects on attitude control system and gas consumption, logic mechanization and integration testing of the attitude control subsystem, and stabilization of the autopilot in a nonflight environment. The procurement of integrated circuits, design and fabrication of the solar panel deploy/damper mechanism, vibration testing of the development test model, and space simulator testing of the temperature control model are reported. Mission sequences which would be implemented if a pressurant or propellant leak occurred, and the failure modes required by additional pyrotechnic valves are mentioned. N.E.N.

N70-36381*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MARINER VENUS-MERCURY 1973 PROJECT
In its Space Programs Sum. No. 37-63, Vol 1 31 May 1970 p 39 – 44 (See N70-36379 20-31)
Copyright. Avail: CFSTI CSCL 22B

Modifications in the power subsystem of the Mariner Mars 1971 designs for adaption to the Mariner Venus-Mercury 1973 space probe are described. These are required primarily for operation in the vicinity of Mercury and for a revised power profile. The power requirements, solar panel, battery, and power conditioning and distribution are described. A briefing with industrial firms is mentioned. N.E.N.

N70-36382*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VIKING PROJECT, ORBITER SYSTEM AND PROJECT SUPPORT
In its Space Programs Sum. No. 37-63, Vol. 1, 31 May 1970 p 45 – 65 (See N70-36379 20-31)
Copyright. Avail: CFSTI CSCL 22B

The telecommunications, guidance and control, space sciences, and project status are reported. The modifications of the Mariner Mars 1971 radio frequency system for the Viking Orbiter

1975 are discussed, along with the relay system. The attitude control roll reacquisition logic, the attitude control subsystem status register, and the scan subsystem mechanization are described. The optimal optical design for the Mars atmospheric water detection spectrometer is outlined, and a ray-trace feasibility model was built.
N.E.N.

N70-36410* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ASSEMBLY FOR RECOVERING A CAPSULE Patent
Alfred P. Warren and Billy D. Lawson, inventors (to NASA) Issued 24 Nov. 1964 (Filed 5 Sep. 1962) 7 p Cl. 244-1
(NASA-Case-XMF-00641; US-Patent-3,158,336; US-Patent-Appl-SN-221945) CSCL 22B

An assembly for opening the stabilizing and decelerating flaps of a flight capsule is described, in connection with means for recovering capsules used in space research. The capsule assembly discussed comprises a means for storing the capsule prior to its recovery, a device for ejecting the capsule from the storage means, a plurality of stabilizing and decelerating flaps adapted to be readily detached from the capsule, and a device for automatically opening and locking the plurality of flaps. Recovery means for the capsule are summarized.
P.A.B.

N70-36654* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LANDING PAD ASSEMBLY FOR AEROSPACE VEHICLES Patent
Josef F. Blumrich, inventor (to NASA) Issued 30 Mar. 1965 (filed 14 Apr. 1964) 7 p Cl. 244-100
(NASA-Case-XMF-02853; US-Patent-3,175,789; US-Patent-Appl-SN-360182) Avail: US Patent Office CSCL 22B

With the object of producing a landing pad which is well adapted for use with a space vehicle landing gear system, landing pads and shock absorbers are treated as separate elements of the system. A hollow spherical curved pad is designed with radially collapsible ribs. The ribs are intended to absorb by collapsing or crumpling a substantial amount of any lateral shock applied to the edge of the pad. A ball joint for securing the pad to the landing gear system is utilized to assure that the pad presents a positive angle of attack to the landing surface. The bottom of the landing pad is covered with a layer of material which shears off at certain frictional forces, in order that a proper frictional force be presented to the pad.
P.A.B.

N70-36675*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
SATURN S-4B-503N STAGE FLIGHT EVALUATION REPORT
Mar. 1969 650 p
(Contract NAS7-101)
(NASA-CR-112371; SM-47008) Avail: CFSTI HC $10.00/MF $0.65 CSCL 22D

Presented are the evaluation results of the prelaunch countdown, powered flight, and orbital phases of the S-4B-503N stage which was launched 21 December 1968 as the third stage of the Saturn AS-503 vehicle.
Author

N70-36744*# California Inst. of Tech., Pasadena.
SURVEYOR SPACECRAFT REAL-TIME PAYLOAD OPERATIONS
Jack N. Lindsley *In* NASA. Washington Opt. Telescope Technol. 1970 p 615–633 refs (See N70-36676 20-14)
Avail: CFSTI HC $10.00/MF $0.65 CSCL 22A

The command and control system for the Surveyor spacecraft is discussed. The operations of the various video and audio systems in real time are described and examples of real-time television mosaics are shown. The operational control procedures were effective in acquiring a large amount of data from the surface of the moon over relatively short periods of available time.
R.B.

N70-36745*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ORBITING ASTRONOMICAL OBSERVATORY MISSION OPERATIONS
H. Robert Lynn *In its* Opt. Telescope Technol. 1970 p 635–643 (See N70-36676 20-14)
Avail: CFSTI HC $10.00/MF $0.65 CSCL 22A

The OAO stabilization and control system, which includes star trackers, rate and position gyros, inertia wheels, and gas jets for attitude control, is described. The spacecraft communications system is fully redundant and consists of two wideband telemetry transmitters, two narrow-band transmitters, two radio tracking beacons, and quad-redundant command receivers. The OAO is operated by pointing the optical axis at a designated point in the sky, conducting a planned series of observations, and recovering the data. An acceptable state of charge by the power system and proper balance of the thermal system are accomplished by maintaining optimum roll, which orients the solar paddles at the optimum position for maximum power.
R.B.

N70-36746*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
APOLLO TELESCOPE MOUNT OPERATIONS AND DATA-HANDLING
James M. Rives *In its* Opt. Telescope Technol. 1970 p 645–656 (See N70-36676 20-14)
Avail: CFSTI HC $10.00/MF $0.65 CSCL 22A

The mission objectives of the Apollo Telescope Mount (ATM) are to obtain precise scientific data and information on the characteristics of the sun through observations of various portions of its electromagnetic spectrum. The ATM is physically integrated with a lunar module that provides the habitation area for the crew and the necessary controls and displays for operating the ATM systems and experiments. The operations of the thermal control, the electrical power, pointing control, instrumentation and communications, and the LM/ATM control and display panel are described. Data handling is accomplished by ground support facilities.
R.B.

N70-36777*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
S-4B-205 STAGE FLIGHT TEST PLAN
Sep. 1968 335 p refs revised
(Contract NAS7-101)
(NASA-CR-112372; SM-46978A) Avail: CFSTI CSCL 22D

This S-4B-205 stage flight test plan documents requirements and responsibilities relative to the S-4B-205 stage of the Saturn IB vehicle AS-205/CSM-101 flight test that will be conducted at the Kennedy Space Center. The test plan defines supporting activities and reports.
Author

N70-36785*+ Douglas Aircraft Co., Inc., Huntington Beach, Calif. Reliability Assurance Operations Dept.
NARRATIVE END ITEM REPORT ON SATURN S-4B-503 (DAC S/N 1007)
J. W. Morris May 1967 182 p
(Contract NAS7-101)
(NASA-CR-112373; DAC-56505) Avail: CFSTI CSCL 22D

Contained herein is a narrative summary of the manufacturing and test records relative to the Saturn S-4-AS-503 flight stage. Narrations are included on those conditions related to permanent nonconformances which were generated during the manufacturing cycle and existed at the time of acceptance testing. The report sets

forth data pertinent to total time or cycle accumulation on time or cycle significant items. Data relative to variations in flight critical components is also included. Author

N70-36827*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
SATURN S-4B-509 STAGE ACCEPTANCE FIRING REPORT
Jul. 1969 262 p
(Contract NAS7-101)
(NASA-CR-112370; DAC-56799) Avail: CFSTI CSCL 22D

Presented is an evaluation of the Saturn S-4-509 stage acceptance firing that was conducted at the Sacramento Test Center on 14 May 1969. Included in this report are stage and ground support equipment deviations associated with the acceptance firing configuration. The acceptance firing test program established the acceptance criteria for buyoff of the stage. Author

N70-36845* Hayes International Corp., Birmingham, Ala.
SPACE CRAFT SOFT LANDING SYSTEM Patent
Timothy O. Eddins, inventor (to NASA) Issued 4 May 1965 (filed 4 Jun. 1964) 9 p Cl. 244–100 Sponsored by NASA
(NASA-Case-XMF-02108; US-Patent-3,181,821; US-Patent-Appl-SN-372727) Avail: US Patent Office CSCL 22B

A spacecraft energy absorbing system of the shock impact type, capable of absorbing large quantities of kinetic energy at a substantially constant rate of deceleration force, is described. The integral landing gear structure has legs suitable for truss type construction connected to a shroud extending around the base of the spacecraft. The legs are connected pivotally to the shroud, and are retracted during flight and extended for landing. The shroud is connected to the spacecraft base through energy absorbers consisting of deformable metal tubes. The absorbers may be oriented horizontally and vertically and give predetermined constant retarding forces depending on the tube material and size. N.E.N.

N70-36852*# National Aeronautics and Space Administration, Washington, D.C.
SPACECRAFT MASS EXPULSION TORQUES
Dec. 1969 39 p refs
(NASA-SP-8034) Avail: CFSTI CSCL 17G

Mass can be ejected from the spacecraft in the solid, liquid, or gaseous state. Determination of the mass expulsion torque requires knowledge of the characteristics of the mass flow and the moment associated with the reaction force. Mass expulsion disturbance torques can occur in several different ways are grouped in three categories: disturbance torques attributable to anomalous behavior or operation of equipment intended to produce a force or torque on the vehicle, disturbance torques caused by equipment intended only to expel mass, and disturbance torques caused by unintended mass expulsion (outgassing or sublimation). Design considerations associated with disturbance torques caused by mass expulsion discussed are (1) identification of the source and assessment of the magnitude of the torque, and (2) control over spacecraft characteristics during design and development to assure that the mass expulsion torque will not exceed the acceptable magnitude. E.M.C.

N70-36995# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
STOPWATCH OBSERVATIONS OF SATELLITES, FEBRUARY 1970
R. D. Eberst 16 Jun. 1970 26 p
(ROE-STS-98) Avail: CFSTI

Stopwatch observations made at stations connected with the section during the month of February 1970 are listed in satellite launch order and in time order for each satellite. Various subtotals are given. Author (ESRO)

N70-37002# Joint Publications Research Service, Washington, D.C.
SUCCESS RATE OF US PIONEER SATELLITES TRACED
Avail: CFSTI

The pioneer space probe program is briefly summarized. It is pointed out that in the first stage only two of nine probes were successful, and that in the second stage (1965-1969) four of five were successfully launched into near-sun orbits and have been sending back information on the sun, especially solar flare date, for several years. The plans of the third stage (1972-1973) are given as launching probes to study the asteroids between Mars and Jupiter orbits, and to study Jupiter from a flyby trajectory. N.E.N.

N70-37013# Rome Univ. (Italy). Scuola di Ingegneria Aerospaziale.
ANALYSIS OF CHARACTERISTICS OF FLUID RING DAMPERS FOR ARTIFICIAL SATELLITES [ANALISI DELLE CARATTERISTICHE DEGLI SMORZATORI AD ANELLO FLUIDO PER SATELLITI ARTIFICIALI]
Ugo Ponzi Dec. 1969 24 p refs In ITALIAN; ENGLISH summary Presented at the AIR-AIDA Congr., Rome, 20–25 Oct. 1969 *Its* ATTI del Centro Ric. Aerospaziali No. 23
Avail: CFSTI

After an investigation of the general conditions concerning the use of fluid-ring damping systems on artificial satellites, this paper gives a solution of the problem of the damping characteristics based on an application of the Green function. Conditions for the maximum efficiency of the system are also discussed. Author (ESRO)

N70-37014# Rome Univ. (Italy). Scuola di Ingegneria Aerospaziale.
ANALOG TECHNIQUE FOR THE STUDY OF NON-STATIONARY RANDOM VIBRATION DATA [UNA TECNICA ANALOGICA PER LO STUDIO DI DATI DI VIBRAZIONE RANDOM NON STAZIONARI]
U. Ponzi, R. Ferroni, and G. Morelli Jan. 1970 36 p refs In ITALIAN; ENGLISH summary Presented at the AIR-AIDA Congr., Rome, 20–25 Oct. 1969 *Its* ATTI del Centro Ric. Aerospaziali No. 24
Avail: CFSTI

The reduction of vibration data from rocket launchings was examined in order to obtain statistical properties for vibration test specifications. The problem was solved by means of a method based on analog techniques and assumptions concerning locally stationary random processes and short time-averaged power spectral densities. Experimental data from a single launch are considered as a sample of a non-stationary random process. The results obtained from the third launch of the ELDO launch vehicle are discussed. Author (ESRO)

N70-37019# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
STOPWATCH OBSERVATIONS OF SATELLITES, JANUARY 1970
R. D. Eberst 19 May 1970 13 p
(ROE-STS-97) Avail: CFSTI

Stopwatch observations made at stations connected with the section during the month of January 1970 are listed in satellite launch order and in time order for each satellite. Various subtotals are given. Author (ESRO)

N70-37147# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
RECONSTITUTION OF THE ATTITUDE OF A PROBE-ROCKET HEAD DESTINED TO ANALYSE THE INFRARED HORIZON [RECONSTITUTION D'ATTITUDE D'UNE POINTE DE FUSEE-SONDE DESTINEE A L'ANALYSE

DE L'HORIZON INFRA-ROUGE]
Marie-Paule Lemaitre and Marcel Bismut 1970 18 p refs In ENGLISH and FRENCH Presented at the 3rd IFAC Symp. on Automatic Control in Space, Toulouse, 2–6 Mar. 1970 Submitted for publication
(ONERA-TP-809) Avail: CFSTI

In the Tacite experiment the nose-cone of a sounding rocket was stabilized in the vertical direction of the launching pad and spun slowly, and three telescopes scanned the horizon to analyse the infrared contrast between earth and space. The detailed reduction of the results entailed an accurate analysis of the attitude of the cone. In spite of slight errors due to gyro-drift and inaccuracies in the alignments of the inertia axes and gas jets, the accuracy was 0.05 deg, while the piloting limit cycle was only 0.25 deg. The attitude variations were computed from a two-star sensor and from the readings on one of the telescopes whose broad bandwidth gave a sharp signal at the horizon. Author (ESRO)

N70-37316*# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
ON THE HIGH-ACCURACY ATTITUDE CONTROL OF SATELLITES IN ELLIPTIC ORBITS
W. H. Boykin, Jr. and I. Fluegge-Lotz Jul. 1967 212 p refs
(Grant NsG-133-61)
(NASA-CR-112359; SUDAAR-322) Avail: CFSTI CSCL 22B

The goal was the development of a class of control systems which efficiently results in high-accuracy earth-pointing attitude motions of satellites of different configurations in elliptic orbits. Linear differential equations with time-varying coefficients, which include terms for the gravity torque due to an oblate earth and terms for the aerodynamic torque, are used to describe the attitude motion when a satellite is practically earth-pointing. Nonlinear equations with time-varying coefficients are used to describe the attitude motion when acquisition of the earth-pointing motion from large deviation angles is considered. Pontryagin's maximum principle, the necessary conditions for exact solutions of optimal bounded-phase-coordinate problems and guidelines obtained from the minimum-fuel station-keeping controls devised for single-axis systems are used in the development of the stationkeeping part of the control system. The acquisition part of the control system results in acquisition of the earth-pointing motion from large angles in the time of one-quarter orbit with comparatively little fuel expenditure. Author

N70-37386*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
THEORY OF THE INJUN 5 VLF POYNTING FLUX MEASUREMENTS
Stephen R. Mosier and Donald H. Gurnett May 1970 24 p refs
(Contracts NAS5-10625; NAS1-8141; NAS1-8144; NAS1-8150 /F/; Grant NGR-16-001-043 et al)
(NASA-CR-112780; Rept-70-34) Avail: CFSTI CSCL 22B

The theory of the VLF Poynting flux measurement technique used on the Injun 5 satellite is presented. This technique consists of using one electric antenna and one magnetic antenna, both oriented perpendicular to the geomagnetic field and to each other, to determine the direction of the VLF Poynting flux up or down the geomagnetic field. The conditions for which the Poynting flux direction determinations are valid are considered, including the effects of errors in the magnetic orientation of the spacecraft and the simultaneous presence of many waves. Author

N70-37456*# Scientific Translation Service, Santa Barbara, Calif.
REGISTRATION OF SPACE OBJECTS AND THEIR LAUNCHES [REGISTRATSIYA KOSMICHESKIKH OBYEKTOV I IKH ZAPUSKOV]
G. Zhukov Washington NASA Sep. 1970 7 p refs Transl. into ENGLISH from Aviats. i Kosmonavt. (Moscow), no. 6, Jun. 1970 p 25–26
(Contract NASw-2035)
(NASA-TT-F-13238) Avail: CFSTI CSCL 22B

The registration of spacecraft, including their launch dates, is handled in the United Nations in response to an order of the General Assembly on December 20, 1961. International centers were established for gathering and exchanging data on space launches in the USA, USSR, and Great Britain also, in accord with the International Geophysical Year program. Author

N70-37560*# TRW Systems Group, Redondo Beach, Calif.
ADVANCED SPACECRAFT VALVE TECHNOLOGY COMPILATION. VOLUME 1: MECHANICAL CONTROLS
Jul. 1970 522 p refs Prepared for JPL
(Contract NAS7-717)
(NASA-CR-112789; TRW-12411-6012-R000-Vol-1) Avail: CFSTI CSCL 22B

The results are presented of the efforts expended during the past several years on advancing the state of the art of valves and controls used on liquid chemical rocket engines for manned and unmanned space exploration vehicles. The controls studied were those used with earth and space storables and cryogenic propellants at pressures to 1000 psia and operate for periods of up to ten years. The ten year requirement was considered in conjunction with missions beyond Jupiter to the outer planets. Considerations were given to electrical, pneumatic (hot and cold gas) and hydraulic actuated valves and actuator concepts. Functional requirements for valves and actuators include zero leakage, service life (1000 to 10,000 cycles), low weight, minimum size, minimum pressure drop, and minimum power consumption. Environmental parametric requirements include zero gravity, radiation, shock and vibration, sterilization (300 F temperature soak, and/or ethylene oxide sterilant), thermal shock, thermal cycling, vacuum, and other effects anticipated by operating for periods of two, five, and ten years in the space and planetary environments. Thrust levels used for specific valve and control applications were 50 lb, 200 lb, and 1000 lb. In Vol. 1 those valves represented by mechanical elements such as diaphragms, seals, hydraulic, pneumatic, and electrical actuators are discussed. In Vol. 2 fluidics and electric and magnetic fluid interaction devices are considered. Author

N70-37561*# TRW Systems Group, Redondo Beach, Calif.
ADVANCED SPACECRAFT VALVE TECHNOLOGY COMPILATION. VOLUME 2: NONMECHANICAL CONTROLS
Jul. 1970 213 p refs Prepared for JPL
(Contract NAS7-717)
(NASA-CR-112790; TRW-12411-6012-R000-Vol-2) Avail: CFSTI CSCL 22B

For abstract see N70-37560.

N70-37571*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
USE OF LOW CONSTANT THRUST TO ACCOMPLISH ORBITAL TRANSFER
Quintin Peasley and Lester Katz 16 Sep. 1969 28 p refs
(NASA-TM-X-53911; MSFC-IN-SSL-N-68-8) Avail: CFSTI CSCL 22A

A fuel-minimized trajectory is generated, satisfying initial and final boundary conditions for the problem of a constantly thrusting space vehicle which is transferred from an initial elliptical orbit around Mars to a circular orbit of lower energy. The constant-thrust solution is amenable to electric ion-propelled spacecraft having an initial elliptical or circular planetocentric orbit which must then be powered to a circular orbit of desired altitude. Author

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N70-36207# Watervliet Arsenal, N.Y. Benet Labs.
THE EFFECT OF MATERIAL REMOVAL ON THE STRENGTH OF AUTOFRETTAGED CYLINDERS
David P. Kendall Jan. 1970 39 p refs
(AD-701049; WVT-7003) Avail: CFSTI CSCL 19/6

Autofrettage is a process which increases the ability of a thick-walled cylinder to contain internal pressure without undergoing plastic deformation by means of producing a system of favorable residual stresses in the cylinder. If material is removed from the cylinder after autofrettage, some of these residual stresses will be removed. This report presents the results of an experimental study of the effect of material removal on the elastic strength of autofrettaged cylinders. The test specimens used were one inch bore diameter cylinders, ranging in diameter ratio from 1.4 to 2.4, of a modified 4330 steel with a yield strength of about 160,000 psi. The specimens were autofrettaged by internal hydrostatic pressure to the complete overstrain condition, thermally treated and machined on either the inside or outside surface. They were then pressure tested to determine their re-yield pressure. The results are compared with those predicted by various theories. Significant differences are noted and are explained in terms of material behavioral phenomena such as the Bauschinger effect and strain aging. Author (TAB)

N70-36210# Naval Ship Research and Development Center, Washington, D.C.
A FINITE ELEMENT ANALYSIS OF LAMINATED ORTHOTROPIC PLATES AND SHALLOW SHELLS Final Report
Benjamin Whang Mar. 1970 93 p refs
(AD-704495; NSRDC-3298) Avail: CFSTI CSCL 20/11

A finite element method is presented for the analysis of laminated orthotropic plates and shallow shells. Preparation of input data is documented and application of the program is illustrated by the analysis of two flat plates and a shallow parabolic cylinders. Author (TAB)

N70-36282# Army Materials and Mechanics Research Center, Watertown, Mass.
STRESS-CONCENTRATION FACTORS IN U-SHAPED AND SEMI-ELLIPTICAL SHAPED EDGE NOTCHES
Francis I. Baratta and Donald M. Neal Jan. 1970 25 p refs
(AD-703121; AMMRC-TE-70-1) Avail: CFSTI CSCL 20/11

Stress-concentration factors are analytically determined for relatively deep, constant radii, U-shaped, edge notches in a semi-infinite sheet with uniaxial tension applied parallel to the sheet edge. Because a strong geometric similarity exists between a U-notch and a semi-elliptical notch of the same tip radius, a comparison of such analytical data is effected. Also compared are stress-concentration factors for U-notches in a semi-infinite sheet to other comparable analytical and experimental data available in the literature. Finite width correction factors are applied to the results of the semiinfinite sheet analysis to provide practical design data. Comparisons of such data are made to experimental results provided by a number of investigators. Author (TAB)

N70-36325*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
A THEORETICAL AND EXPERIMENTAL MODEL-STUDY OF THE SOUND-INDUCED VIBRATION TRANSMITTED TO A SHROUD-ENCLOSED SPACECRAFT Final Report, 20 Jan. 1967–20 Jul. 1969
Jerome E. Manning 1 May 1970 135 p refs
(Contract NAS5-10302)
(NASA-CR-112413; Rept-1891) Avail: CFSTI CSCL 20K

Results are presented from a three year study of the vibration transmitted to a shroud-enclosed spacecraft from an external acoustic field. The study included both a theoretical prediction of the vibration transmission and an experimental study of 1/2-scale model of a typical spacecraft assembly. The theoretical predictions were obtained using a statistical energy analysis. Data from the experiments are compared with the predictions to establish the validity and accuracy of the prediction technique. Experiments were also conducted to determine the effect of changes in the model configuration on the vibration transmission. The results of the study indicate that the vibrations transmitted via the internal acoustic space and those transmitted via the mounting trusses are comparable. Author

N70-36331 Mitsubishi Heavy-Industries, Ltd., Tokyo (Japan).
STRESS ANALYSIS OF PLATE AND FRAMED STRUCTURES BY FINITE ELEMENT METHOD
Yoshiaki Nakao (Hiroshima Tech. Inst.), Masahiro Yamashita (Hiroshima Tech. Inst.), and Masao Kawashima (Hiroshima Tech. Inst.) May 1970 10 p refs In JAPANESE; ENGLISH summary
(MTB-66) Copyright. Avail: Issuing Activity

In the design of built-up plate structures, especially joints, cutouts and other complicated parts, theoretical stress analysis was so difficult that designers usually estimated stresses of such structures using experiment or experimental data. To eliminate these difficulties, computer programs of stress analysis of arbitrary shaped built-up plate and framed structure were developed using finite element method. The analysis of membrane and bending stress of plates by this method is carried out by the use of a triangular element with 3 nodes. Expressing the assumed displacement state over element as third order polynomial, it is convenient to analyze the combined plate and frame structure. Moreover, eccentric stiffener can be considered. Numerical examples show good agreement with experimental results or exact solutions; some applied results are presented. Author

N70-36332# European Atomic Energy Community, Ispra (Italy). Metallurgy and Ceramics.
DETERMINATION OF TRANSVERSE STRENGTH OF FINNED TUBES. COMPARISON OF EXPLOSION TEST AND RING TEST [DETERMINATION DE LA RESISTANCE TRANSVERSALE DE TUBES AILETES. COMPARAISON ENTRE L'ESSAI D'EXPLOSION ET LE 'RING TEST']
D. J. Boerman and M. Veaux Luxemburg EURATOM May 1970 28 p refs In FRENCH; ENGLISH summary
(EUR-4457.f) Avail: CFSTI

In advanced technology, finned tubes are more and more widely used. In the nuclear field, particularly, they are often used as sheath tubes for fuel elements. These tubes are ordinarily stresses by internal hydrostatic pressure and, consequently, the determination of transverse properties is of great interest. The ring test is employed in place of the burst test as the reception test and the stress patterns in the two tests have been determined on photoelastic models. These results have been confirmed by those obtained through mechanical testing (tensile tests, burst tests, ring tests). It is concluded that the ring test is an excellent technological test. Nevertheless, as it gives only relative values, it must be compared with classical methods for each type of material and particular shape of tube. Author

N70-36338# Naval Research Lab., Washington, D.C. Strength of Metals Branch.
THE INFLUENCE OF YIELD STRENGTH AND FRACTURE TOUGHNESS ON FATIGUE DESIGN PROCEDURES FOR STRUCTURAL STEELS Final Report
T. W. Crooker and E. A. Lange 19 Feb. 1970 23 p ref
(AD-702737; NRL-7036) Avail: CFSTI CSCL 13/13

The failure of welded structures by fatigue can be viewed as crack growth between two flaw sizes forming fixed boundary conditions. The initial condition is a rapidly initiated or pre-existing flaw, and the terminal condition is the critical flaw at failure. This report outlines the modes of failure and methods of analysis for fatigue design for structural steels ranging in yield strength from 30 to 300 ksi. Fatigue crack propagation characteristics of steels seldom vary widely in response to broad changes in yield strength and fracture toughness. However, strength and toughness do vary widely among structural steels and thereby exert profound effects on the fatigue failure process. By applying the principles of the NRL Ratio Analysis Diagram, an analysis shows that the ratio of plane strain fracture toughness to yield strength can be employed to determine fatigue design procedures. Author (TAB)

N70-36385# Naval Ship Research and Development Center, Washington, D.C.
STATIC STRESSES ON WIDE-BLADED PROPELLERS Final Report
Justin H. Mc Carthy and Joseph S. Brock Feb. 1970 37 p refs
(AD-704492; NSRDC-3182) Avail: CFSTI CSCL 13/10

Static stresses were obtained in laboratory experiments for a destroyer propeller, having aerofoil blade sections, and a super-cavitating propeller, having wedge-shaped blade sections, using specially constructed pressure chambers that allowed the blade faces to be loaded under air pressure. A new method for applying beam theory is presented that closely predicts the magnitude and distribution of radial stresses on the destroyer propeller blade. For the supercavitating propeller, neither the proposed beam-theory method nor a particular computerized-shell analysis can be considered entirely satisfactory for prediction of blade stresses. Author (TAB)

N70-36391# Liege Univ. (Belgium).
BIFURCATION OF ECCENTRICALLY LOADED MEMBERS AND OF STIFFENED PLATES Technical Report, Jul.–Sep. 1969
A. P. Kabaila (Univ. of Sidney, Australia) Wright-Patterson AFB, Ohio AFFDL Mar. 1970 35 p refs
(Contract F61052-69-C-0004)
(AD-704571; SA-18; AFFDL-TR-70-37) Avail: CFSTI CSCL 13/13

Elastic eccentrically loaded members buckle by a combination of twisting and bending about their weak axis. By the finite element method any end conditions are readily incorporated into the solution. The critical loads can be determined of eccentrically loaded columns of a plate girder type, as well as the critical loads of stiffened or unstiffened plates subjected to varying membrane stresses. The basic tools of the solution are two elements developed herein, namely a quadrilateral plate element subjected to linearly varying membrane stresses for the webs, and an element of a prismatic member subjected to a linearly varying axial force for the flanges and the stiffeners. Complete polynomials are used for the definition of the displacement field. Consequently the solution leads to an upper bound of the critical load with an assured convergence. The same elements can be used for the determination of the critical loads associated with the lateral buckling of beams, which are subjected to the loads in the plane of the web. This class of problems is also discussed. Author (TAB)

N70-36477*# Computer Sciences Corp., Los Angeles, Calif.
NASTRAN PROJECT Final Report
2 Mar. 1970 62 p refs
(Contract NAS5-10049)
(NASA-CR-112405) Avail: CFSTI CSCL 20K

The history of the NASTRAN Project, the features of the program, and the physical aspects of the NASTRAN system are described. The sparse matrix routines for decomposition and multiplication of large matrices are discussed for computerized structural analysis. The eigenvalue techniques provide a set of tools for attacking large order eigenvalue problems effectively. The numerical integration algorithm is stable for a wide spectrum of practical problems without sacrificing either accuracy or efficiency. By choosing to use double-precision arithmetic in key areas, accurate solutions can be obtained from models including thousands of grid points. Author

N70-36498# Naval Postgraduate School, Monterey, Calif.
A CURVILINEAR SHELL FINITE ELEMENT
Dean William Kiess (M.S. Thesis) Dec. 1969 86 p refs
(AD-704514) Avail: CFSTI CSCL 13/13

A doubly curved element for a shell of revolution which has arbitrarily curved meridians is developed and analyzed. Meridional curvature is calculated using a highly accurate polynomial approximation. The displacement functions selected satisfy interelement compatibility and contain all the lower modes of a complete set of straining functions. Non-straining modes corresponding to rigid body motions are introduced into the final stiffness matrix for any conceivable rigid body motions. The direct stiffness method was used to construct a stress and strain analysis program and the results of the analysis of a few problems are compared to classical solutions to establish the integrity of the element. Author (TAB)

N70-36502# Wisconsin Univ., Madison. Mathematics Research Center.
THE DISPLACEMENTS PRODUCED IN A COMPOSITE INFINITE SOLID BY AN IMPULSIVE TORSIONAL BODY FORCE
G. Eason and R. R. M. Wilson Aug. 1969 51 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-704577; MRC-TSR-986) Avail: CFSTI CSCL 8/11

The problem considered here is that of the displacement produced by an impulsive torsional body force situated within an elastic half-space which is bonded to a half-space of different material properties. Author (TAB)

N70-36520# Liege Univ. (Belgium).
BIFURCATION OF SPACE FRAMES Technical Report, Jul.–Sep. 1969
B. Fraeijs De Veubeke and A. P. Kabaila (Univ. of Sidney, Australia) Wright-Patterson AFB, Ohio AFFDL Mar. 1970 53 p refs
(Contract F61052-69-C-0004)
(AD-704570; SA-17; AFFDL-TR-70-36) Avail: CFSTI CSCL 13/13

A finite element for a prismatic member subjected to axial loads is derived for the stability analysis of elastic space frames. The derivation is based on the face that in a stable state of equilibrium the second variation of the total energy is positive definite. A feature of the element developed is that the reduction of torsional rigidity due to the presence of axial stresses is taken into account. Several examples are presented. An excellent agreement with analytical results is obtained, where closed form solutions are available. Author (TAB)

N70-36536* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

INFLATABLE HONEYCOMB Patent
Emanuel Schnitzer, inventor (to NASA) Issued 23 Feb. 1965 (Filed 23 Apr. 1962) 7 p Cl. 135-1
(NASA-Case-XLA-00204; US-Patent-3,170,471; US-Patent-Appl-SN-189648) Avail: US Patent Office CSCL 13M

Durable, lightweight, honeycomb panel elements making up inflatable structures are described. These structures are designed to be foldable for transit into a compact package and inflatable, when ready for use, to assume an erected rigid configuration useful in numerous applications. Large building structures, lightweight space satellites, and solar collectors, to be stored in a compact state within a payload portion of a carrier vehicle, are among the considerations for these panels. E.M.C.

N70-36570*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
STRESS CONCENTRATION DUE TO A HYPERBOLOID CAVITY IN A THIN PLATE
Robert E. Reed, Jr. and Phillip R. Wilcox Washington Aug. 1970 19 p refs
(NASA-TN-D-5955; A-3608) Avail: CFSTI CSCL 20K

Space structures subjected to meteoroid impacts that do not penetrate the structure may still be locally overstressed because of the stress concentration of the surface cavity. Experimental and numerical results from the digital computer program NASTRAN are presented for the stress concentration of hyperboloid cavities in thin elastic plates statically loaded in uniform biaxial tension (or compression) in the plane of the plate. One hemispherical and two hyperboloid shapes are considered. The radius of the plate was large compared to that of the cavity and the cavity depth ranged from 25 to 80 percent of the plate thickness. The plate material was assumed to be elastic, isotropic, and homogeneous. Results include the stress concentration factors for various ratios of hole depth to plate thickness and some plots of the spatial variation of stress to indicate the type of distribution that exists. Author

N70-36582# National Engineering Lab., Glasgow (Scotland). Computer Stress Analysis and Creep Div.
APPLICATIONS OF THE REFERENCE STRESS CONCEPT: PREDICTION OF CREEP DEFORMATION OF THICK-WALLED CYLINDERS FROM UNIAXIAL TENSION CREEP DATA
J. Fairbairn Oct. 1969 22 p refs
(NEL-436) Copyright. Avail: CFSTI

The thick-walled cylinder under internal pressure was selected as a particular example for investigation of the reference stress concept as a tool for analysis of creep deformation in structures and components. It is established that the concept is valid for stress functions other than simple n power relationships and therefore is applicable to a wide range of engineering materials. Reference stress techniques may also be applied usefully to situations beyond the confines of small-strain solutions. Author

N70-36592*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MEASURED AND PREDICTED LONGITUDINAL VIBRATIONS OF A LIQUID PROPELLANT TWO-STAGE LAUNCH VEHICLE
Robert R. Clary and Lloyd J. Turner, Jr. Washington Aug. 1970 61 p refs
(NASA-TN-D-5943; L-6646) Avail: CFSTI CSCL 20K

An experimental and analytical program was conducted to investigate the longitudinal vibration properties of a two-stage full-scale launch vehicle loaded with various amounts of simulated propellants. A two-dimensional finite-element mathematical model formulated from vehicle physical parameters and experimental results was the basis for free- and forced-vibration analyses. Good agreement was obtained between the measured and predicted responses. Vector-response plots enhanced the interpretation of experimental and forced-vibration analytical results. Proper identification and correlation of the modes required a knowledge of the accelerations along the length of the vehicle, accelerations of specific components such as the engines and the turbopump, and pressures at the top and bottom of the propellant tanks. Author

N70-36595*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SPACE TRANSPORTATION SYSTEM TECHNOLOGY SYMPOSIUM. VOLUME 2: DYNAMICS AND AEROELASTICITY
Jul. 1970 370 p refs Symp. held at Cleveland, 15-17 Jul. 1970; sponsored by NASA, Washington, D.C.
(NASA-TM-X-52876-Vol-2; E-5866) Avail: CFSTI CSCL 20K

Conference papers pertain to dynamic loads and response, aeroelasticity, and flight dynamics and environment. For individual titles, see N70-36596 through N70-36615.

N70-36596*# Lockheed Missiles and Space Co., Huntsville, Ala.
ASSESSMENT OF CURRENT METHODS FOR DYNAMIC ANALYSIS OF COMPLEX STRUCTURES
K. J. Forsberg *In* NASA. Lewis Res. Center Space Transportation System Technol. Symp., Vol. 2 Jul. 1970 p 4-27 (See N70-36595 20-32)
Avail: CFSTI CSCL 20K

An assessment of the state-of-the-art for determining eigenvalues of large systems is presented. Topics discussed include: (1) basic methods of dynamic analysis, (2) structural modeling, (3) techniques for finding eigenvalues, (4) matrix reduction, and (5) complex structure modal analysis. F.O.S.

N70-36597*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
APPLICATION OF DYNAMIC MODELS
H. Wayne Leonard and Homer G. Morgan *In its* Space Transportation System Technol Symp., Vol. 2 Jul. 1970 p 29-42 refs (See N70-36595 20-32)
Avail: CFSTI CSCL 20K

Structural dynamic models were used to obtain vibration data required in launch vehicle development. A generalized model is used to obtain lateral response data on space shuttle configurations to account for new factors such as parallel staging, lifting surfaces, and interface stiffness. A second generation generalized model with representative longitudinal responses is also developed. Finally, a detailed nearly-replica dynamic model of the final space shuttle configuration is proposed as the most cost-effective technique for obtaining timely vibration data to establish confidence in the design. Author

N70-36598*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PANEL VIBRATION AND RANDOM LOADS
William C. Walton, Jr. and Eugene C. Naumann *In its* Space Transportation System Technol. Symp., Vol. 2 Jul. 1970 p 43-57 (See N70-36595 20-32)
Avail: CFSTI CSCL 20K

Procedures to predict basic vibration characteristics and random response of thermal protective system panels were studied in very thin skins of about 0.01 inch thickness. Thermal pressures, stiffening, and changes in the modulus of elasticity are considered in determining the natural vibration modes of the system for response analysis. Vibration testing, and structural damping are also discussed. F.O.S.

N70-36600*# Grumman Aircraft Engineering Corp., Bethpage, N.Y.
TRANSIENT LOADING CONSIDERATIONS FOR SHUTTLE DESIGN
E. F. Baird *In* NASA. Lewis Res. Center Space Transportation System Technol. Symp., Vol. 2 Jul. 1970 p 79–100 refs (See N70-36595 20-32)
Avail: CFSTI CSCL 20K

Some of the transient-response problems of the space shuttle vehicle are reviewed, and a combined test and analytic technique that could be a valuable supplement to the standard methods for calculating transient response is introduced. The technique relies on using experimentally determined impulse transfer functions to predict structural responses to longer-duration inputs. The transient loadings the shuttle will encounter from liftoff to landing are summarized. Author

N70-36601*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
SPACE SHUTTLE LIFTOFF DYNAMICS
Donald C. Wade *In its* Space Transportation System Technol. Symp., Vol. 2 Jul. 1970 p 101–122 (See N70-36595 20-32)
Avail: CFSTI CSCL 20K

The potential impact on structural weights and on crew and payload environments by space shuttle liftoff dynamics is studied as an important design consideration. Many factors associated with liftoff dynamics and the potential areas affected by them are presented. The merits of discrete versus statistical analyses of the condition are discussed and recommendations are made to assist in finding an optimum blend of criteria, analysis, and operations which will result in an efficient and adequate design. Author

N70-36602*# General Dynamics/Convair, San Diego, Calif.
SPACE SHUTTLE STAGING DYNAMICS
R. H. Schuett, M. O. Clark, and M. J. Hurley *In* NASA. Lewis Res. Center Space Transportation System Technol. Symp., Vol. 2 Jul. 1970 p 123–142 refs Sponsored in part by NASA (See N70-36595 20-32)
Avail: CFSTI CSCL 20K

A summary is presented on separation analyses conducted during the NASA Phase A space shuttle study, the Air Force (SAMSO) space transportation system study, and company sponsored research which evaluated separating multiple bodies placed symmetrically about a center core. An aft hinge system with separation force supplied by inertial and aerodynamic reactions was recommended. With the piggyback arrangement, other schemes could be required. Concepts using rails, links, thrusters and pistons are discussed with advantages and shortcomings of each system identified. Factors to be evaluated for system comparison include system weight, performance losses, separation clearance time history, abort capability, and costs. Supporting research and technology necessary for selection and definition of a space shuttle separation system are identified. Brief discussions cover interference aerodynamics, plume impingement heating and pressures, and propellant motions during abort. Author

N70-36605*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LIFTING AND CONTROL SURFACE FLUTTER
Robert C. Goetz *In its* Space Transportation System Technol. Symp., Vol. 2 Jul. 1970 p 177–198 refs (See N70-36595 20-32)
Avail: CFSTI CSCL 20K

Employing the space shuttle vehicle as a center of discussion, several potential problem areas of lifting and control surface flutter are surveyed. Topics very briefly discussed include flutter of planar lifting surfaces, stall flutter, interference flutter, control surface instabilities, and liftingbody - surface flutter. Proposed or needed research in those areas where the state of the art is not presently sufficient to insure a safe and reliable space shuttle mission are delineated. Author

N70-36606*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STATE OF THE ART FOR PANEL FLUTTER AS APPLIED TO SPACE SHUTTLE HEAT SHIELDS
Sidney C. Dixon and Charles P. Shore *In its* Space Transportation System Technol. Symp., Vol. 2 Jul. 1970 p 199–221 refs (See N70-36595 20-32)
Avail: CFSTI CSCL 20K

Heat shields considered for the space shuttle generally have flexible supports and may have orthotropic stiffness properties. The state-of-the-art for the supersonic flutter of this type of panel is briefly summarized. Considerable work has been done for panels with elastic edge restraint on two opposite edges. Results from these investigations which indicate the effects of elastic edge restraint, panel stiffness orientation, unequal support stiffness on opposite edges and elastic coupling to an elastic substructure, are discussed. Four analytical methods presently considered for analysis of panels with arbitrary support on all four edges and experimental programs required for verification of these techniques are indicated. Author

N70-36609*# Aerospace Corp., Los Angeles, Calif.
PREVENTION OF COUPLED STRUCTURE-PROPULSION INSTABILITY (POGO) ON THE SPACE SHUTTLE
S. Rubin *In* NASA. Lewis Res. Center Space Transportation System Technol. Symp., Vol. 2 Jul. 1970 p 249–262 ref (See N70-36595 20-32)
Avail: CFSTI CSCL 20K

The nature of the pogo phenomenon is briefly described, and a summary of past instabilities is presented. The possible deleterious effects of pogo are related, and the contents of the design criteria monograph discussed. Research tasks are recommended for support of pogo development activities on the space shuttle. Author

N70-36610*# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
INFLUENCE ON THE POGO EFFECT OF THE AERODYNAMIC PHENOMENA IN A ROCKET AFTERBODY
Marcel Barrere, Jacques Bouttes, and Jean Lemoine (Lab. de Rech. Balistiques et Aerodynamiques) *In* NASA. Lewis Res. Center Space Transportation System Technol. Symp., Vol. 2 Jul. 1970 p 263–265 (See N70-36595 20-32)
Avail: CFSTI CSCL 20K

The vibrations known as pogo effect result from a coupling between the structure, the tanks and lines, and the motor of a liquid propellant rocket stage. One of the elements of the coupling is due to the forces applied on the structure by periodical variations of the combustion chamber pressure. The influence that aerodynamic phenomena in the afterbody may have on the value and the nature of these forces is investigated. After pointing out the main parameters of the problem, two particular cases are briefly examined: a single nozzle rocket operating at low level (L 17 booster of the DIAMANT B launcher), and a multi-nozzle rocket operating at high altitude. Author

N70-36611*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
VIBRATION ENVIRONMENT
R. W. Schock *In its* Space Transportation System Technol. Symp., Vol. 2 Jul. 1970 p 273–284 (See N70-36595 20-32)
Avail: CFSTI CSCL 20K

Some of the expected acoustic fatigue characteristics of space shuttle thermal protection system (TPS) design concepts are

presented. Vibration response and fatigue characteristics are compared. Areas where supporting research is needed to provide the required reliability and confidence in the TPS design are defined. Author

N70-36613*# Canadair, Ltd., Montreal (Quebec).
DYNAMIC RESPONSE OF ANTENNA STRUCTURES IN A LAUNCH ENVIRONMENT
A. C. S. Hayden *In* NASA. Lewis Res. Center Space Transportation System Technol. Symp., Vol. 2 Jul. 1970 p 301–329 refs (See N70-36595 20-32)
Avail: CFSTI CSCL 20K

The dynamic responses of various proposed designs of an antenna-feedhorn combination for a communications satellite to random excitation in the launch environment are determined using beam and plate finite elements idealizations, in both normal mode and impedance solutions, and applying power spectral density techniques. Statistical results in the form of mean square values, exceedances of load levels, and cumulative damage form the design criteria. The same digital programs can be used to determine space shuttle responses for various dynamic loading considerations, particularly during launch and staging. Sets of compatible elements which could be used in the finite element idealization of the complex space shuttle structure are presented. Author

N70-36614*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPACE VEHICLE RESPONSE TO ATMOSPHERIC DISTURBANCE
Robert S. Ryan *In its* Space Transportation System Technol. Symp., Vol. 2 Jul. 1970 p 331–348 refs (See N70-36595 20-32)
Avail: CFSTI CSCL 20K

State of the art approaches to dynamic analysis for predicting and interpreting the response of a space vehicle to atmospheric disturbances are presented. The basic technology development needed for the space shuttle concept is identified. Critical technology areas discussed are as follows: performance criteria, nonstationary aerodynamics, adaptive load relief schemes, criteria for control sensor choice and location, system models accuracy and computational technique speed, modal or subsystem decoupling techniques, and techniques for accurately incorporating data tolerances in responses. Special inflight dynamic problems which are expected for the space shuttle vehicle due to its varied mission and innovated design are identified. Author

N70-36615*# North American Rockwell Corp., Downey, Calif.
ASSESSMENT OF THE POTENTIAL FOR LOAD ALLEVIATION CONCEPTS FOR SPACE SHUTTLE VEHICLES
R. H. Lassen and J. H. Wykes *In its* Space Transportation System Technol. Symp., Vol. 2 Jul. 1970 p 349–363 Sponsored in part by NASA (See N70-36595 20-32)
Avail: CFSTI CSC 20K

With regard to the application of automatic control systems to alleviate induced loads and/or control structural mode dynamics in meeting the stringent structural mass fraction requirements of the space shuttle vehicle (SSV), the state of the art in load alleviation and mode control is reviewed. Some of the recent techniques are discussed, and the potential of such systems for the SSV assessed. Problems requiring solution, along with the supporting programs to supply these solutions, are outlined. Author

N70-36623# National Engineering Lab., Glasgow (Scotland). Materials Group.
THE DIAGNOSIS OF SERVICE FAILURES
J. E. Field and D. Scott Sep. 1969 21 p refs
(NEL-433) Copyright. Avail: CFSTI

The importance of correct diagnosis is explained. The primary failure may have to be isolated from secondary damage. Information on design, manufacture and service conditions is helpful. A close inspection of the failed components, by eye with the aid of optical and electron microscopes, often yields much information. Fracture surfaces generally need careful cleaning. Metallographical investigation, mechanical tests and chemical analysis may be required. Crack detection techniques may be useful. Types and causes of failure are listed, with examples and appropriate remedies. Prevention is better than cure and inspection techniques useful in the diagnosis of impending failure are noted. Author

N70-36671# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
STRESS CONCENTRATION IN AN ELASTOMERIC SHEET SUBJECT TO LARGE DEFORMATIONS Interim Technical Report
Alexander Segal and J. M. Klosner Mar. 1970 76 p refs
(Contract DAHC04-69-C-0019)
(AD-705378; PIBAL-70-11; AROD-7448-2-E) Avail: CFSTI CSCL 11/10

Biaxial and uniaxial experiments have been conducted on a thin sheet of natural rubber, which can be assumed to be incompressible, isotropic, and perfectly elastic. The strain energy function and constitutive equations have been determined, and the material is classified as a Generalized Rivlin-Mooney type. Biaxial experiments were then conducted on the same sheet with a circular cutout and stress concentration factors were obtained. Results indicate a significant increase in the factor with increased displacements. A modified Particle-In-Cell (P.I.C.) method has been developed and analytical results were obtained for a sheet with a rigid circular inclusion. It is shown that the stress concentration factor for a Rivlin-Mooney material increases with increasing deformations, a result which is in qualitative agreement with solutions obtained by other methods. The use of the Generalized Rivlin-Mooney material, however, leads to a decrease in stress concentration with increasing deformations. Author (TAB)

N70-36708*# Massachusetts Inst. of Tech., Cambridge.
APPLICATION OF FINITE ELEMENT TECHNIQUES TO THE DESIGN AND MANUFACTURE OF ASTRONOMICAL MIRRORS
Keto Soosaar *In* NASA, Washington Opt. Telescope Technol. 1970 p 249–255 refs (See N70-36676 20-14)
Avail: CFSTI HC $10.00/MF $0.65 CSCL 20K

The finite element approach permits the analyst to treat problems of continuum mechanics as well as trusses and frames in a very general way without becoming excessively involved with the detailed behavioral aspects of the problem at hand. The absolute generality of the method and the ease of use makes the finite element method an ideal tool for treating the complex elastomechanics problems that arise in the design, manufacture, and operation of telescope mirror structures. Author

N70-36709*# Massachusetts Inst. of Tech., Cambridge.
SELF-WEIGHT LOADED STRUCTURES IN THE CONTEXT OF LIGHTWEIGHT MIRROR APPLICATIONS
J. P. Duncan *In* NASA, Washington Opt. Telescope Technol. 1970 p 257–280 refs (See N70-36676 29-14)
Avail: CFSTI HC $10.00/MF $0.65 CSCL 20K

Mirrors are frequently supported at three or more points by statistically determined supporting systems. Various methods are employed to calculate self-weight deflections resulting from distributed gravitational body forces to obtain optimum self-weight loaded mirror design structures. Example calculations use arches in placed of flexed structures and sectioned beams to distribute the

cross sectional area of the member better. Numerically controlled milling machines are used to logically lighten plate-fabricated structures by lightening holes so that the residual material is in optimum configuration. G.G.

N70-36711*# Defense Dept., Washington, D.C.
STRUCTURAL DEFORMATION OF AN ORTHOTROPIC PLATE
Francis W. Niedenfuhr *In* NASA, Washington Opt. Telescope Technol. 1970 p 283–286 (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 20K

The effects of structurally induced orthotropy in elastic plates are studied in an effort to control local deformations in an optical systems design. Analyzed is an infinite circular plate, bounded by a hole, where it is subjected to three concentrated forces separated from each other by 120 degrees; this structure carries the weight of a large mirror into a three point kinematic support. Example calculations show that ring reinforcements are very effective for damping out circumferential bending which induces optically damaging mirror deformation; radial reinforcements inhibit radial bending, but not circumferential bending. G.G.

N70-36712*# Itek Corp., Lexington, Mass.
TRANSVERSE DEFLECTIONS OF A 45-INCH DIAMETER, LIGHTWEIGHT MIRROR BLANK: EXPERIMENT AND THEORY
W. P. Barnes *In* NASA, Washington Opt. Telescope Technol. 1970 p 287–290 refs (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 20K

In the design of lightweight mirror structures consisting of two thin plates connected by a core structure whose mean density is substantially less than that of a solid core, the influence of shear forces on the total deflection may equal or exceed that of the pure bending behavior of the mirror blank. Considered is the case of a centrally loaded mirror supported at three points equally spaced around the edge of the blank. The theoretical calculation for this case is developed and compared with deflections measured, by using holographic interferometry, on a 45-inch-diameter mirror blank. Author

N70-36721*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
BEHAVIOR OF STRUCTURAL JOINTS AND ASSEMBLIES UNDER THERMAL ENVIRONMENT
Rondal G. Crawford *In its* Opt. Telescope Technol. 1970 p 335–349 (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 20K

Thermostructural and alignment tests as well as structural joint studies were performed on a 200-pound earth reentry vehicle in order to obtain design guidelines for sterilization of spacecraft structures and Mars landing capsules. Emphasis was placed on the response of structural and mechanical components to temperatures extending from 25 to 150 C, and to heat-soak duration of up to 64 hours. Results established that structural distortions due to heat sterilization are minimal and that mounting of alignment sensitive components is not unduly complicated. Selection, design, and fabrication of joints to withstand the thermal cycling environment does not seem to be a limiting problem. G.G.

N70-36725*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
CONSIDERATIONS IN THE DESIGN OF ORBITAL TELESCOPES FOR DYNAMIC ENVIRONMENTS
C. E. Lifer and R. E. Jewell *In its* Opt. Telescope Technol. 1970 p 389–400 refs (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 20K

The acoustic, vibration, and shock environments to which a space telescope might be subjected by different launch vehicles are described. The current state-of-the-art approaches to designing for such environments and some of the unusual aspects of telescope design for dynamics are discussed. Author

N70-36726*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THERMAL DEFORMATION PREDICTION IN ORBITING OBSERVATORY STRUCTURES
James B. Mason *In its* Opt. Telescope Technol. 1970 p 401–415 refs (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 20K

A background discussion of the finite element method as it is applied to static thermal deformation problems and to thermally induced vibration problems is included. Work being done under the Structural-Thermal-Optical Program is summarized, and examples of the two general classes of thermal deformation problems considered in this program are given. An example of the treatment of thermally induced vibrations of a flat plate is included to demonstrate the applicability of the finite element method to this class of problem. The free vibration analysis of the OAO spacecraft and its correlation with OAO modal-survey tests is described. The reduction scheme used to reduce the size of the frequency model for use in an independent forced-response analysis of the entire launch vehicle and spacecraft is discussed. The potential of the finite element method in the analysis and design of optical space telescopes is also discussed. Author

N70-36753*# Barry Wright Corp., Watertown, Mass.
VIBRATION ISOLATION OF LARGE MASSES AND VACUUM CHAMBERS
Robert W. Crawford *In* NASA, Washington Opt. Telescopes Technol. 1970 p 733–749 refs (See N70-36676 20-14)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 20K

The theory of vibration isolation is discussed with respect to the environment, the equipment to be isolated, and the isolation systems and their controls. Electronic feedback control systems are considered as a means of attaining improved attitude and position control and low-frequency isolation. The systems approach is suggested as an application to improving vibration isolation in the middle to high frequency ranges. This is accomplished by controlling the source of vibration and by designing laboratory equipment with high resonant frequencies and good damping properties. R.B.

N70-36788# Israel Inst. of Tech., Haifa. Dept. of Mechanics.
ON VIBRATIONS OF HETEROGENEOUS ORTHOTROPIC CYLINDRICAL SHELLS
Yehuda Stavsky and Raphael Loewy Aug. 1969 45 p refs Sponsored by Israel Academy of Sciences and Humanities, ARPA/ONR, and AFML
(TDM-69-4) Avail: CFSTI

A refined Love-type theory of motion was established for orthotropic composite cylindrical shells. An extensional-rotational dynamic coupling effect was shown to exist, expressed by R sub 1 inertia terms. An extended version of the theory was formulated to account for dynamic stability problems involving time-dependent and nonconservative forces. The frequency spectra of free natural vibrations were investigated for numerous layered shells, using Love and Donnell-type theories, including the effects of R sub 1 terms. Heterogeneity was found to affect the results for the natural frequences: for certain shells produced from a fixed amount of materials, differing only in their arrangement, a suitable composition raised the lowest frequency by a factor of 1.50. A study of the error involved in a Donnell-type theory was carried out. Devistions were, in several instances, associated with different predictions of the corresponding lowest characteristic mode shapes. Higher errors, strongly depending on shell heterogeneity, were noted as the length-to-radius ratios increased beyond 5. Author

N70-36889*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Engineering Mechanics Div.
APPLIED MECHANICS
In its Space Programs Sum. No. 37-62, Vol. 3 30 Apr. 1970 p 181–202 refs (See N70-36876 20-34)
Copyright. Avail: CFSTI CSCL 20K

A progress report is presented on development of a large scale advanced composite, filament-wound pressure vessels suitable for use in a space-storable liquid propulsion system. The nonlinear vibration of a couple structural system is discussed, with all the other component systems being linear. An exploratory testing program is outlined for evaluation of vehicle mobility performance on soft, level, and sloping terrains. Specific information is given about vehicle characteristics, soil material, equipment, instrumentation, and an analysis of test results. The estimated cooling requirements for the thermoelectric outer planet spacecraft infrared detector are given. A program was initiated to develop reliable design data for advanced composite materials strength and to provide an understanding of fracture behavior to insure reliability of pressure vessels. A thermal joint conductance study is briefly summarized. J.A. M.

N70-36975# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
RECENT ADVANCES IN PHOTOELASTIC STRESS ANALYSIS. SEPARATION OF THE MAIN STRESSES AND AUTOMATION OF MEASUREMENTS [PROGRES RECENTS REALISES EN PHOTOELASTICIMETRIE. SEPARATION DES CONTRAINTES PRINCIPALES ET AUTOMATISATION DES MESURES]
Henri Loiseau 1970 15 p refs In FRENCH; ENGLISH summary Presented at the 4th Intern. Conf. on Stress Analysis, Cambridge, Engl., 7–10 Apr. 1970 Submitted for publication
(ONERA-TP-812) Avail: CFSTI

Photoelasticity gives the distribution and differences between main stresses and holographic interferometry can then be used to obtain their sum and so separate them. The chief difficulty in all interferometric procedures arises from the superposition of two fringe patterns. One is connected with the variation in the thickness of the model when under the loading system, i.e. with the sum of stresses, and the other is produced by birefringence. To eliminate the latter, use was made of a property of polyester resins whereby the sign of their Brewster constants reverses with temperature variations. The technique makes use of a single model and gives accurate results. Author (ESRO)

N70-37133*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
BODIES OF CONSTANT STRESS EXPERIENCING FORCES OF ORBITAL FLIGHT
A. Gerald Pierce 12 Jun. 1970 20 p ref
(NASA-TM-X-64532) Avail: CFSTI CSCL 20K

Preliminary data accumulated from a study of the cross sectional areas of symmetrical bodies in which a constant stress is maintained while experiencing the forces associated with orbital flight are presented. An analysis is made of the forces associated with beams or cables extended from a satellite orbiting earth in a circular orbit. An investigation of the cross sectional areas necessary to maintain constant stress throughout the beams is made, and the area relationships are resolved for different altitudes using a type of steel for the material of the beams. A discussion of the problem is given, and a mathematical analysis which produces a relationship between the cross sectional areas of the beams and distances from the center of the earth is provided. The mathematical data are supplemented with diagrams and several graphs. Author

N70-37355# Atomic Energy Board, Pretoria (South Africa).
WELWING: A FORTRAN 4 COMPUTER CODE FOR BUCKLING CALCULATIONS ON CYLINDRICAL FUEL ELEMENTS
A. Koster May 1969 45 p refs
(PEL-183) Avail: AEC Depository Libraries

The computer program was developed to calculate the material buckling of reactor systems consisting of annular fuel elements in heavy water as moderator. An analytical solution of the one-group diffusion equations is given and the various corrections and approximations applied are fully described. The results obtained agree well with experimental data for annular fuel elements containing natural U as well as for solid fuel elements of slightly enriched U. Author (NSA)

N70-37414# Birkenhead (Warren), Inc., Seattle, Wash.
RECENT PROGRESS OF UNIFIED PICTURE TO STRENGTH, FRACTURE AND FATIGUE OF MATERIALS
Takeo Yokobori 1970 38 p Transl. into ENGLISH from Japanese Article In ENGLISH and JAPANESE Sponsored by AEC
(PB-191713T; WBI-C-1517-BI; AEC-tr-7149) Avail: CFSTI CSCL 11/6

Contents: Mathematical mechanics of cracks and fractures; Microscopic mechanism and macroscopic behavior of brittle fracture; Induction of brittle fracture law based on microscopic mechanism; Problematical points in fatigue mechanism; Mechanism of fatigue crack generation; Mechanism of fatigue crack spread; Unified view on fatigue fracture; Kinetic treatment of fracture including fatigue life; Yield and low cycle fatigue; Fatigue due to fluctuating load; High temperature crepe fracture; Reliability and nonfracture probability. USGRDR

N70-37432# Maryland Univ., College Park. Dept. of Civil Engineering.
CURVED GIRDER COMPUTER MANUAL Progress Report
Lansford C. Bell and Conrad P. Heins, Jr. Sep. 1969 157 p refs Sponsored in part by Md. State Roads Comm. and Bur. of Public Roads
(PB-191355; Rept-30) Avail: CFSTI CSCL 13M

Three computer programs based on analytical techniques of the slope deflection Fourier Series previously developed under this HP and R study are presented. The COBRA (Curved Orthotropic Bridge Analysis) slope deflection computer programs can be used to analyze a statistically loaded curved bridge structure. Girder deflections, rotations, and internal forces are determined by each of the three basic programs. A stress or strain subroutine may be included to compute stresses and strains throughout the structure. Composite or noncomposite girder-slab action may be specified. Any number of concentrated loads may be applied, referenced to any radius and angle of the bridge coordinates. A uniformly distributed load may be superimposed over the concentrated loading if desired. USGRDR

N70-37482# Denver Research Inst., Colo.
STRESS FIELDS: HALF SPACE WITH A PRESSURIZED SPHERICAL CAVITY: INFINITE MEDIUM WITH TWO PRESSURIZED SPHERICAL CAVITIES Final Report
J. A. Weese Oct. 1969 59 p refs Prepared for Sandia Corp., Albuquerque, N. Mex.
(PB-188119; DRI-2523; SC-CR-69-3287) Avail: CFSTI CSCL 20K

Analyzed is the state of stress in two closely related axisymmetric problems: (1) a half space containing a pressurized spherical cavity at an arbitrary position below the plane surface and (2) an infinite space containing two spherical cavities of arbitrary size and separation distance, each subjected to an arbitrary pressure. The results presented in this report include: definitions of the problems, modifications required in an earlier analysis, the modified computer program, operating instructions for the modified program, and a discussion of the numerical results with emphasis on the interference effect of pressurized cavities near plane boundaries and the interaction of two pressurized cavities. Results are presented in graphical form. Author (USGRDR)

N70-37492*# Scientific Translation Service, Santa Barbara, Calif.
THE DERIVATION OF THE STABILITY CRITERIA OF ELASTIC EQUILIBRIUM FROM THE ELASTICITY THEORY OF FINITE DEFORMATIONS [UEBER DIE ABLEITUNG DER STABILITAETSKIRITERIEN DES ELASTISCHEN GLEICHGEWICHTES AUS DER ELASTIZITAETSTHEORIE ENDLICHER DEFORMATIONEN]
E. Trefftz Washington NASA Sep. 1970 14 p Transl. into ENGLISH from Proc. of the 3d Intern. Congr. for Appl. Mech., Vol. 3, Stockholm, 24–29 Aug. 1930 p 44–50
(Contract NASw-2035)
(NASA-TT-F-13201) Avail: CFSTI CSCL 20K

Elastic stability criteria are derived based on linear elasticity laws and the calculus of variations. The first and second variations of the work of deformation (potential energy) determine stability in general. The results are applied to the buckling column problem. Author

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N70-36229# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DETERMINING THE HEAT-TRANSFER COEFFICIENTS OF THE FRAMES OF ELECTRICAL MACHINES SELF-COOLED IN PARTIAL VACUUM
M.N. Ulyanitskii 26 Feb. 1970 13 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Elektromekhan. (Novocherkassk), no. 6, 1966 p 630–636
(AD-704003; FTD-HT-23-66-70) Avail: CFSTI CSCL 9/3

The results are reported of an experimental investigation of heat transfer from horizontally and vertically oriented electric machines in a large vacuum chamber under all possible conditions (viscosity, molecular viscosity, and molecular) of free motion of air. Pressures from 10 minus super 5 to 760 torr were created in a vacuum chamber whose relative size permitted simulating infinite space heat exchange conditions. Four electric machine frame simulators having diameters of 40,80,100, and 140 mm were tested. The relations found from the above experiments generally corroborate the well known theory of heat exchange in vacuum. Thus, a serious reduction in the heat transfer within the 0.6 to 760 torr range can be explained by the decreasing convection; a constant heat transfer in the 0.1 to 0.7 torr range is due to the approaching of thermal conduction conditions. A heat transfer reduction at pressures under 0.1 torr can be explained by a boundary layer effect, viz., a temperature step that characterizes molecular viscosity conditions. In the molecular range the heat conductance was proportional to the pressure; no such relation was observed in the experiments because of the blackness of the machine simulators. Author (TAB)

N70-36252# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HEAT EXCHANGE AND RESISTANCE DURING THE FLOW OF ARGON IN A PIPE WITH HIGH WALL TEMPERATURES
V. I. Toluginskii et al 20 Feb. 1970 11 p refs Transl. into ENGLISH from the Russian
(AD-703887; FTD-HT-23-90-70) Avail: CFSTI CSCL 20/13

An experimental investigation was carried out for high temperature heat exchange and hydraulic resistance coefficient for a flow of argon gas flowing in molybdenum pipes of 12 to 10 mm diameter, 500 to 800 mm long, externally heated to 1470 to 1865K. The gas temperature at the pipe inlet was 320 to 710K, and at the outlet end 874 to 1147K; the Reynolds number at the inlet of the pipe and the ratio of wall temperature to as flow temperature varied between 1.26 and 3.8. The experimental results were in good agreement with those from empirical formulas. Author (TAB)

N70-36290# Centre d'Etude de l'Energie Nucleaire, Mol (Belgium).
TEMPERATURE CONTROL OF IRRADIATION EXPERIMENTS BY CHANGES IN GAS PRESSURE [TEMPERATURREGELUNG VON BESTRAHLUNGSPROBEN DURCH GASDRUCKVERAENDERUNG]
W. Hebel Luxemburg EURATOM May 1970 26 p refs In GERMAN; ENGLISH summary *Its* Assoc. No. 006-60-5 BRAB (EUR-4478.d) Avail: CFSTI

A process is described for setting the temperature of a heated or cooled body at a desired value and for controlling or adjusting this temperature as required. The process is based on the transfer of heat through a gas gap between parallel or concentric walls, where the heat conductivity of the gas is changed by means of its own pressure. For irradiation of material in test reactor BR2, Mol, an automatic temperature control system working on the same principle was constructed and put into operation in the spring of 1969. Author

N70-36395# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SCIENTIFIC AND TECHNICAL SOCIETY OF THE POWER INDUSTRY. CENTRAL BOARD. SECTION ON GASIFICATION: THEORY AND PRACTICE OF GAS COMBUSTION: SELECTED ARTICLES
Sh. A. Ershin et al 23 Oct. 1969 41 p refs Transl. into ENGLISH from Russian reports
(AD-700475; FTD-HT-23-247-69) Avail: CFSTI CSCL 21/2

Contents: Aerodynamics of a turbulent diffusion flame developing in cocurrent coaxial jets; The physical model of flameholding on blunt bodies; Development and stability of a diffusion gas flame in the wake of transverse air jets. TAB

N70-36450# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE OPERATION OF AN AIR-FEED JET COMBUSTION CHAMBER UNDER UNSTABLE CONDITIONS
I. P. Goldaev et al Oct. 1969 12 p Transl. into ENGLISH from Samoletostr. Tekh. Vozdush. Flota (USSR), no. 5, 1966 p 59–64
(AD-700801; FTD-HT-23-354-68) Avail: CFSTI CSCL 21/2

An attempt was made to find the reasons for and the conditions under which pressure fluctuations occur in air-feed jet combustion chambers, and to study the effect of certain structural factors on the stabilization of the process. Author (TAB)

N70-36561# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF ACOUSTIC CASES OF VIBRATIONAL COMBUSTION
V. B. Shteinberg 1 Oct. 1969 10 p refs Transl. into ENGLISH from Tr. Tsentr. Nauchno-Issled. Proektno-Konstrukt. Kotloturbinnyi Inst. (USSR), no. 64, 1965 p 42–45
(AD-700402; FTD-HT-23-425-68) Avail: CFSTI CSCL 21/5

The author analyzes intermittent combustion in cases where the excitation mechanism is acoustic in nature, i.e. where disturbances of the combustion process are determined by pulsations in the velocity and pressure of the flow before the combustion zone. Some information on the excitation mechanism may be derived by studying the behavior of the flame with a change in the acoustic properties of the channels before and after the combustion

zone. Formulas are derived for determining the amplitude-phase characteristics of transfer functions of the combustion zone. These relationships may be used for studying the properties of non-stationary oscillations during flame propagation.
Author (TAB)

N70-36617* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THERMAL CONTROL OF SPACE VEHICLES Patent
Dewey L. Clemmons, Jr., inventor (to NASA) Issued 6 Apr. 1965 (filed 3 May 1963) 8 p Cl. 244-1
(NASA-Case-XLA-01291; US-Patent-3,176,933; US-Patent-Appl-SN-277961) Avail: US Patent Office CSCL 22B

A passive thermal coating and a method of applying it to an aluminum foil are described for inflatable space vehicles with radio beacons. A three-layer laminate consists of a flexible plastics section with aluminum foil adhesively bonded to the opposite surfaces. The exterior foil surfaces are coated chemically with an adherent amorphous metallic phosphate whose thickness is carefully controlled. The coating is Alodine which contains approximately 50-55% chromium phosphate, 17-23% aluminum phosphates and 22-33% water, with traces of aluminum, chromium, and calcium fluorides. The laminate has a solar absorptance to low temperature emittance ratio of 1.67 which given average surface temperature range of 45-70 C, the desired range for the radio beacons. Details of the coating and cleaning processes are included. N.E.N.

N70-36666# Harry Diamond Labs., Inc., Washington, D.C.
DIGITAL PROGRAM FOR SOLVING THE TWO-DIMENSIONAL HEAT FLOW PROBLEM
Howard M. Bloom Nov. 1969 54 p refs
(AD-700992; HDL-TM-69-38) Avail: CFSTI CSCL 20/13

A FORTRAN IV program has been written to solve the two-dimensional heat flow problem. The program may contain up to nine regions of heat flow; each may have several types of boundary conditions (isothermal, adiabatic, contact, etc). The initial temperature distribution may be point-by-point, linear, exponential or sinusoidal. The alternating direction implicit method was used to approximate the partial differential equation. The program was designed for use on the IBM 7094 digital computer.
Author (TAB)

N70-36723*# Grumman Aircraft Engineering Corp., Bethpage, N.Y.
THERMAL DESIGN OF A SATELLITE TELESCOPE
J. Rogovin and N. Kosowski *In* NASA, Washington Opt. Telescope Technol. 1970 p 359-379 (See N70-36676 20-14)
Avail: CFSTI HC $10.00/MF $0.65 CSCL 13A

The present state-of-the-art in thermal control, the advanced techniques to be used on large astronomy vehicles, and the design considerations generic to advanced spacecraft are reviewed. The general thermal design and performance of the OAO passive/active control system are presented along with analytical, test, and flight data. Candidate thermal control techniques for advanced spacecraft are reviewed with particular emphasis given to heat pipes, louvers, insulations, and coatings. Design concepts for the advanced OAO 3 and OAO 4 satellites are included. Author

N70-36727*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CONSIDERATIONS ON PRECISION TEMPERATURE CONTROL OF A LARGE ORBITING TELESCOPE
S. Katzoff *In its* Opt. Telescope Technol. 1970 p 417-424 (See N70-36676 20-14)
Avail: CFSTI HC $10.00/MF $0.65 CSCL 3A

The results of calculations relative to quantitative specification of the temperature uniformity and temperature constancy of a large orbiting telescope are presented. The basic idealized configuration is a large telescope made of 1 mm thick aluminum and wrapped in superinsulation. The types of radiation environment considered correspond roughly to synchronous and near-earth orbits. Possible ways of eliminating the problem by using heated collars near the tube opening, heat pipes and vapor chambers, and enclosing balloons are discussed. Author

N70-36846* Chance Vought Corp., Dallas, Tex.
COUPLING FOR LINEAR SHAPED CHARGE Patent
Homer T. Armstrong, inventor (to NASA) Issued 27 Apr. 1965 (filed 10 Sep. 1962) 6 p Cl. 102-49 Sponsored by NASA
(NASA-Case-XLA-00189; US-Patent-3,180,264; US-Patent-Appl-SN-223003) Avail: US Patent Office CSCL 19A

A coupling device for a space vehicle abort system is described which joins the shaped charge, booster charge, and squib into a compact unit. The shaped charge is received at one end of the coupling, the squib at the other end, and the booster charge is housed between. The device controls the power density of the shaped charge, can be mass produced, and can be modified easily for different sized shape charges and squibs. N.E.N.

N70-36847* Hughes Aircraft Co., Los Angeles, Calif.
THERMAL SWITCH Patent
John M. Bozajian, inventor (to NASA) Issued 13 Apr. 1965 (filed 15 Feb. 1963) 7 p Cl. 165-96 Sponsored by NASA
(NASA-Case-XNP-00463; US-Patent-3,177,933; US-Patent-Appl-SN-259487) Avail: US Patent Office CSCL 20M

A thermal switch is described which selectively transfers heat from one region to a second heat dissipating region to maintain the first region at a constant temperature. The switch consists of a thermally conductive plate with two thermally conducting contacts, one fixed and the other moveable and controlled by bimetallic strips. N.E.N.

N70-36945# Dartmouth College, Hanover, N.H. Thayer School of Engineering.
CONDENSATION OF STEAM IN A CONSTANT AREA DUCT, PART 2
Andrej Aplenc Jan. 1970 35 p refs
(Grant NSF GK-1841)
(PB-190189) Avail: CFSTI CSCL 20D

A description of the condensation of steam in a vertical pipe of constant cross section using a one dimensional mathematical model and the Reynolds flux concept is presented.
Author (USGRDR)

N70-36960# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.
COMBUSTION AS APPLIED TO ENGINEERING
D. B. Spalding Jun. 1970 26 p Presented at the Conf. on Mech. Eng. and Mech., Haifa, Israel, Jul. 1970
(CCK/TN/A/3) Avail: CFSTI

Combustion physics research applications in engine and industrial furnace development are reviewed, and a mathematical model for turbulence combustion kinetics is described. E.C.

N70-37066*# Scientific Translation Service, Santa Barbara, Calif.
THE INSTITUTE OF HIGH TEMPERATURES OF THE USSR ACADEMY OF SCIENCES. THE MOST IMPORTANT RESULTS OF SCIENTIFIC RESEARCH IN 1969
Washington NASA Aug. 1970 85 p refs Transl. into ENGLISH of the book "Institut Vysokikh Temperatur Akademii Nauk SSSR Vazhneyshiye Rezultaty Nauchno-Issledovatelskikh Rabot 1969 Goda' Moscow, Nauka Press, 1970 p 1-62
(Contract NASw-2035)
(NASA-TT-F-13152) Avail: CFSTI CSCL 20M

CONTENTS:

1. RESEARCH ON THERMOPHYSICAL AND ELECTROPHYSICAL PROPERTIES OF MATTER AT HIGH TEMPERATURES p 4–23 (See N70-37067 20-33)

2. STUDY OF HIGH TEMPERATURE PROCESSES OF HEAT TRANSFER, MASS TRANSFER, PHYSICAL GAS DYNAMICS, AND MAGNETOHYDRODYNAMICS p 24–38 (See N70-37068 20-33)

3. DEVELOPMENT AND STUDY OF NEW HEAT-RESISTANT STRUCTURAL MATERIALS p 39–44 (See N70-37069 20-18)

4. DEVELOPMENT OF INSTALLATIONS FOR DIRECT CONVERSION OF HEAT INTO ELECTRICAL ENERGY BY MEANS OF MHD-GENERATORS AND OTHER NEW ENERGY DEVICES p 45–83 refs (See N70-37070 20-34)

N70-37067*# Scientific Translation Service, Santa Barbara, Calif.

RESEARCH ON THERMOPHYSICAL AND ELECTROPHYSICAL PROPERTIES OF MATTER AT HIGH TEMPERATURES

In its The Inst. of High Temp. of the USSR Acad. of Sci. The Most Important Results of Sci. Res. in 1969 Aug. 1970 p 4–23 (See N70-37066 20-33)

Avail: CFSTI CSCL 20M

Research reported includes the following: (1) The interaction of electromagnetic fields with a plasma in the microwave range was investigated. The velocity of the ionization front propagation was measured in argon, nitrogen, and air at pressures ranging from 10 to 760 mm Hg. At atmospheric pressure in argon, the measured velocity values of the front reached 1000 m/sec for a flux density of superhigh frequency energy on the order of 3 V/sq cm. (2) The density of B203 was studied by a hydrostatic weighing method in an almost isothermal zone in a device having a height of the order of 100 mm, the maximum temperature difference did not exceed 3 to 4 deg C in height for a temperature level of 1900 C. (3) The influence of anistropy on the thermophysical properties of pyrolitic graphite was investigated. It was established that the thermoconductivity and electrical resistance of pyrographite depends essentially on the treatment temperature. D.L.G

N70-37068*# Scientific Translation Service, Santa Barbara, Calif.

STUDY OF HIGH-TEMPERATURE PROCESSES OF HEAT TRANSFER, MASS TRANSFER, PHYSICAL GAS DYNAMICS, AND MAGNETOHYDRODYNAMICS

In its The Inst. of High Temp. of the USSR Acad. of Sci. The Most Important Results of Sci. Res. in 1969 Aug. 1970 p 24–38 (See N70-37066 20-33)

Avail: CFSTI CSCL 20M

Research reported includes the following: (1) Unusual results were obtained in an investigation of heat transfer to gaseous NH3 in a laminar flow in the hydrodynamic initial section of a circular pipe. It was assumed that as the ratio of temperature of the wall and liquid increases the heat transfer decreases. The results, however, point to an opposite conclusion, which is apparently related to the stronger temperature dependence of the thermal conductivity coefficient in ammonia as compared to diatomic gases. (2) experimental relationships were obtained among the true volume vapor contents, wall temperatures, circulation multiplicity factors, and degrees of the lack of equilibrium along the length of the channel in two-phase stationary flows. (3) An experimental investigation of the composition of a gas stream behind a strong shock wave was made under conditions of incidence on an inclined surface and with a mutual interaction of the shock wave with the barrier. (4) Theoretical and experimental research on nonstationary magnetohydrodynamic processes was conducted. D.L.G.

N70-37069*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A GENERAL TRANSIENT HEAT-TRANSFER COMPUTER PROGRAM FOR THERMALLY THICK WALLS

L. Bernard Garrett and Joan I. Pitts Washington Aug. 1970 153 p refs

(NASA-TM-X-2058; L-6850) Avail: CFSTI CSCL 20M

A general heat-transfer program is presented, which employs a finite-difference method for the solution of temperature histories of one-dimensional, two-dimensional, or spherical systems. Options are available for heat input given in tabular form, computed from a trajectory, or computed from a temperature history given for a specific location. The type of heat exchange are: (1) conduction; (2) convection - with (a) given heat input, (b) heating due to skin friction with Van Driest equations, (c) stagnation heating with Sibulkin, Detra-Kemp-Riddell, and Cohen equations; (3) radiation-out; (4) air-conduction; and (5) joint conduction. The system configuration is specified by an arbitrary number of discrete elements and their interrelationships. Author

N70-37168*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EXPERIMENTAL INVESTIGATION OF HEAT-TRANSFER DISTRIBUTIONS IN DEEP CAVITIES IN HYPERSONIC SEPARATED FLOW

Allan R. Wieting Washington Sep. 1970 29 p refs

(NASA-TN-D-5908; L-7059) Avail: CFSTI CSCL 20M

An experimental study was conducted in a 7-inch Mach 7 pilot tunnel to determine the local cold-wall convective heating rates to small rectangular cavities with width-depth ratios varying from 0.063 to 0.524. The tests were conducted at a nominal Mach number of 7.0, zero angle of attack, stagnation temperatures of approximately 3000 deg and 3400 deg R (1700 and 1900 K) stagnation pressures of approximately 1600 and 2000 psia (11 and 14 MN/sq m), and free-stream unit Reynolds numbers between approximately 14 and 23 million per foot (46 and 70 million per meter). The results of the study indicate that the local convective heat flux to the cavity increases with cavity width, is a maximum at the top of the forward-facing wall, and decreases monotonically along the wetted perimeter of the cavity. The experimental heat flux distributions are in good agreement with theory when the flow within the cavity is primarily inviscid. The results also indicate that the average cavity heat flux is, in general, less than the corresponding flat-plate heat flux. Author

N70-37323# Iowa State Univ. of Science and Technology, Ames. Engineering Research Inst.

UNSTEADY HEAT TRANSFER TO A SEMI-INFINITE SOLID WITH ARBITRARY SURFACE TEMPERATURE HISTORY AND VARIABLE THERMAL PROPERTIES

William J. Cook Feb. 1970 32 p refs

(PB-190040; ISU-ERI-AMES-67500) Avail: CFSTI CSCL 20M

Methods are presented that incorporate the variation of thermal properties with temperature into the determination of the heat flux to and the total heat absorbed by a semi-infinite isotropic solid initially at uniform temperature with arbitrary surface temperature variation with time. A relatively simple procedure is presented that permits evaluation of heat flux and the total heat transfered when thermal properties other than diffusivity vary. A second method based on a well-known finite difference approximation of the governing equations accounts for variation in all thermal properties. Results obtained confirm that significant errors may be introduced into the calculation of heat transfer quantities if variation in thermal properties is ignored. Author (USGRDR)

N70-37328# Dartmouth Coll., Hanover, N.H. Thayer School of Engineering.

THERMAL STABILITY OF A PLANE WALL

Graham B. Wallis Apr. 1970 20 p refs

(Grant NSF GK-1841)

(PB-191938; DC-27327-8) Avail: CFSTI CSCL 20M

The thermal stability of a plane wall which exchanges heat at its boundaries has been investigated. It has been shown that instability can occur if one of the boundaries is subjected to a heat flux which decreases as the temperature difference increases. The criterion for stability under these circumstances is given in terms of the thermal resistance of the wall and the rates of change of heat flux with temperature difference at the boundaries. The wall resistance has a destabilizing effect. A similar analysis can presumably be carried out for composite walls or more complex thermal circuits. The analysis predicts the onset of large excursions in the wall temperature. For certain practical problems a more important consideration may be the magnitude of temperature fluctuations resulting from imposed perturbations.
Author (USGRDR)

N70-37341# Weapons Research Establishment, Adelaide (Australia).
DYNAMIC TESTING OF MISSILE TRACKING FLARES, PART 2
R. H. Weldon and G. M. Hensel Feb. 1969 24 p ref
(WRE-TM-CPD-129-Pt-2) Avail: CFSTI

The burning performance of two types of missile tracking flare was tested under acceleration of 220 g both longitudinal to and in one case transverse to the flare's axis. The tests carried out are reported. The results indicated that missile tracking flares based on either of the two compositions, SR568A and WR116, could be used on missiles with accelerations of at least 220 g. Author

N70-37373# Hawaii Inst. of Geophysics, Honolulu.
AN INTEGRAL EQUATION APPROACH TO DIFFUSION PROBLEMS
Richard Paul Shaw Jan. 1970 35 p refs
(PB-191282; HIG-70-1) Avail: CFSTI CSCL 20 M

A method of solution of transient diffusion problems in homogeneous and isotropic media with internal sources and arbitrary (including nonlinear) boundary conditions and initial conditions is proposed. Heat conduction is taken as the physical basis of the problem although the approach is applicable to any other physical diffusion process. The method is based on the reduction of the problem to one only involving surface values of temperature and/or heat flux in the form of an integral equation through the introduction of fundamental solutions and the use of Green's theorem. The integral equation is solved numerically for two specific examples.
Author (USGRDR)

N70-37387*# Alabama Univ., University. Bureau of Engineering Research.
TWO PHASE FLOW AND HEAT TRANSFER IN POROUS BEDS UNDER VARIABLE BODY FORCES Final Report, Part 6
John R. Mc Donald and Harold R. Henry May 1970 117 p refs
(Contract NAS8-21143)
(NASA-CR-102822; FR-113-30-Pt-6) Avail: CFSTI CSCL 20M

The feasibility of investigating two-phase fluid flow and heat transfer in porous beds in a reduced gravity environment is studied. The development of the breadboard packages is described. This includes test models of the channel for the study of liquid and its vapor and the channel for the study of liquid and foreign gas flow. Also included in the breadboard packages are pumps, motors, instrumentation and peripheral equipment for power and data recording. The description of the design, development and construction of the breadboard for the vapor-bubble experiment and an account of some fundamental experiments that were conducted on this equipment are included. Water and water vapor were circulated through the closed system of which the principal apparatus was a vertical channel packed with spherical glass beads. Boiling occurred at a resistance heater located in the channel near its upstream end. The parameters measured were liquid flowrate (obtained where one-phase flow existed); centerline and wall temperatures, wall pressures, and saturation (ratio of the volume of one-phase to the total volume of both phases) at several cross sections.
Author

N70-37388*# IIT Research Inst., Chicago, Ill. Technology Center.
DEVELOPMENT OF SPACE-STABLE THERMAL-CONTROL COATINGS Triannual Report, 1 Jan. – 30 Apr 1970
J. E. Gilligan and G. A. Zerlaut 1 Jul. 1970 61 p refs
(Contract NAS8-5379; ITRI Proj. U6002)
(NASA-CR-102826; ITRI-U6002-90) Avail: CFSTI CSCL 20M

The concept, design, construction, characterization and performance of the solar wind-proton simulation facility, designated Combined Radiation Environment Facility (CREF), is described in this report. The CREF consists of three modules, one of which, the space-ultraviolet simulator, is not physically coupled to the other two. The proton accelerator (solar wind simulator) is physically coupled to the basic IRIF-II facility, the vacuum system that provides for sample manipulation, irradiation and in situ hemispherical spectral reflectance measurement. Performance objectives are all either met or exceeded.
Author

N70-37438# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.
DEVELOPMENT OF IMPROVED HEAT TRANSFER SURFACES. PART 3: AIR RIG TESTS ON CHAMFERED RIBBED SURFACES
C. Warburton Jan. 1970 20 p refs
(RD/B/N-1595) Avail: AEC Depository Libraries

Heat transfer and pressure drop tests on a range of surfaces roughened by widely-spaced, chamfered transverse ribs show that a worthwhile improvement in performance can be obtained if the rib height is reduced below the present AGR value or if the rib volume is increased. A surface with the same volume as AGR and an 18% lower rib showed a gain in Stanton number of 5%. The best surface tested had a total volume equivalent to an increase in AGR can volume of 5%. Allowing for changes in Stanton number and friction factor this surface showed a gain in performance of 9.5%. The best chamfer angle for this type of surface is about 12 deg.
Author (NSA)

N70-37466*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
STUDY OF CONVECTIVE HEAT TRANSFER TO CONES AND CYLINDERS AT ANGLE OF ATTACK Final Report
W. G. Dean, C. J. Wojciechowski, and A. G. Bhadsavle May 1970 106 p refs
(Contract NAS8-24535)
(NASA-CR-102824; LMSC/HREC-D162315; HREC-4535-1) Avail: CFSTI CSCL 20M

A study effort directed toward developing handbook-type methods for predicting, without undue conservatism, aerodynamic heating rates to cones and cylinders at angle of attack is summarized. Applicability of these isolated body methods to composite body geometries consisting of cones and cylinders is discussed. Approximate methods for compression and expansion corner regions are given. In general, the test data trends were predicted well by several theories. Using the heat transfer theories that correlated best with the test data, extrapolations to typical boost trajectory flight conditions were made, and the results are presented in the form of graphs that can be used for rapid estimates of aerodynamic heating rates. To aid in the calculation, the local flow field properties for cones and cylinders are presented. Finally, two example calculations are made to illustrate the use of the graphs presented.
Author

N70-37575*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE HEAT PIPE EXPERIMENT
R. D. Shelton 16 Sep. 1969 13 p ref
(NASA-TM-X-53930; MSEC-R-SSL-INN-67-10) Avail: CFSTI CSCL 20M

A system capable of achieving a constant and uniform temperature over a sizable volume was described. It is relatively immune to problems of localized heat additions and subtractions and possesses remarkable simplicity, low cost, and reliability properties, and is susceptible to simple and direct operational checks under space conditions. Author

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N70-36351# Joint Publications Research Service, Washington, D.C.
SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 233
29 Jul. 1970 88 p Transl. into ENGLISH from Russian reports (JPRS-51049) Avail: CFSTI

CONTENTS:
1. ASTRONOMY p 1–4 (See N70-36352 20-30)
2. METEOROLOGY p 5–11 (See N70-36353 20-20)
3. OCEANOGRAPHY p 12–17 (See N70-36354 20-13)
4. TERRESTRIAL GEOPHYSICS p 18–28 (See N70-36355 20-13)
5. UPPER ATMOSPHERE AND SPACE RESEARCH p 29–70 (See N70-36356 20-30)
6. SUPPLEMENT p 71–81 (See N70-36357 20-31)

N70-36434# Naval Postgraduate School, Monterey, Calif.
A NONLINEAR INTEGER PROGRAMMING MODEL FOR EXPANDING THE TRANSPORTATION SYSTEM OF AN UNDERDEVELOPED COUNTRY OR REGION
Bernard Michael Martin (M.S. Thesis) Oct. 1969 68 p refs
(AD-706060) Avail: CFSTI CSCL 5/1

A nonlinear integer programming model for expanding the transportation system of an underdeveloped country is presented. The model uses integer 0-1 decision variables. The basic model has linear constraints and a nonlinear objective function. Some special situations and extensions to the model are presented. The benefits being maximized in the objective function are discussed, as are the problems of parameterization and suboptimization. A solution procedure for the model is suggested, but an efficient algorithm is not available for solving the model. Some areas for future research are also suggested. Author (TAB)

N70-36452# National Bureau of Standards, Washington, D.C. Technical Analysis Div.
NATIONAL BUREAU OF STANDARDS MODELING FOR THE NORTHEAST CORRIDOR TRANSPORTATION PROJECT
John Donaldson, Jane Duberg, Richard Ku, Gerald Miller, and William O'Neal Dec. 1969 133 p
(PB-190933; NECTP-213) Avail: CFSTI CSCL 13B

A description of the model and the procedures used are presented. Included is an algorithm for measuring transportation system characteristics, a model for forecasting travel demands, the interface procedure, a common carrier assignment model, and the processing procedure. Experience derived from the application of the model system is used in examining transportation problems, and possibilities for improving them. Author (USGRDR)

N70-36453# Resource Management Corp., Inc., Bethesda, Md.
THEORY AND IMPLEMENTATION OF COST AND BENEFIT ANALYSIS OF TRANSPORTATION SYSTEMS: THE NECTP
Luis Sanchez, Oskar Morgenstern, Klaus-Peter Heiss, Kan-Hua Young, and Solita Monsod Dec. 1969 298 p refs Prepared in cooperation with Mathematica, Inc.
(Contract DOT-FR-9-0044)
(PB-190945; NECTP-225) Avail: CFSTI CSCL 13B

The report presents the theory and application of transportation cost analysis methodology within a framework based on economic efficiency principles and on the application of welfare economics to decision-making in the transportation sector. The principles governing the efficient allocation of resources in transportation are set forth and adjustments required for market imperfections are discussed. Economic theory is applied to costing methods and techniques, and finally both transportation cost and productivity are brought together within a Pareto optimal framework for purposes of exploring the proper use of costs in decision-making. Author (USGRDR)

N70-36488# Lincoln Lab., Mass. Inst. of Tech., Lexington.
GENERAL RESEARCH Quarterly Technical Summary Report, 1 Nov. 1969 – 31 Jan. 1970
Frederick C. Frick, Herbert G. Weiss, Robert H. Kingston, John F. Hutzenlaub, and Alan L. Mc Whorter 15 Feb. 1970 49 p ref
(Contract AF 19(628)-5167)
(AD-704573; ESD-TR-70-6) Avail: CFSTI CSCL 17/9

Contents: Surveillance techniques; Digital computers; Psychology; Computer systems; Educational technology; Air traffic control; Optics and infrared; Mechanical engineering; Control systems; Microelectronics; and Solid state device research. TAB

N70-36513# Office of Aerospace Research, Arlington, Va.
COUPLING OF SCIENCE TO TECHNOLOGICAL DEVELOPMENT (REVIEW OF CONCEPTS AND LESSONS ABOUT RESEARCH AND DEVELOPMENT COUPLING: THE IMPLICATIONS FOR RESEARCH AND DEVELOPMENT POLICIES)
Alexander G. Hoshovsky and Ernest P. Luke Oct. 1969 17 p refs
(AD-704569; OAR-69-0022) Avail: CFSTI CSCL 5/1

The paper defines coupling as a multidirectional flow of information which brings the social problems, goals and requirements into productive association with the potential of science and technology. It describes coupling dimensions and reviews a number of lessons derived from experience of those who performed or aided in the performance of coupling functions. The report concludes that productive science-technology coupling usually occurs as a by-product of other worthwhile objectives and seldom as a result of the managements attempt to show that productive coupling exists. The adequacy of coupling can be evaluated only if there is a clear definition of what kind of coupling is being considered. Since there are many natural and man-made obstacles to coupling, successful coupling programs require strong support of top and middle managements, presence of clear and challenging objectives, existence of reasonably attractive incentives and committment of adequate resources. Author (TAB)

N70-36515# Resource Management Corp., Inc., Bethesda, Md.
EXTERNAL COSTS AND BENEFITS ANALYSES, NECTP
Paul F. Dienemann and Armando M. Lago Dec. 1969 107 p refs
(Contract DOT-7-35297)
(PB-190944; NECTP-224) Avail: CFSTI CSCL 13B

Rational decision-making in the transportation sector requires consideration of externalities or third party effects. The study quantifies the incommensurable and imputed monetary values of costs and benefits of alternative NEC transportation system impacts on: noise, air pollution, aesthetics, safety, air and highway

congestion, as well as the employment benefits from system construction. A final tableau of social costs and benefit impacts summarizes the monetary values of incremental impacts of new NECTP transportation modes (highspeed rail, tracked air cushion vehicles, STOL, and VTOL) over the social costs of a 1975 base case composed of auto, bus, conventional air, and the continuation of current NEC demonstration rail projects underway. Author (USGRDR)

N70-36631# Maryland Univ., College Park. Center of Materials Research.
MATERIALS SCIENCES PROGRAM Annual Technical Report, 1 Jul. 1968 – 30 Jun. 1969
Jun. 1969 44 p refs
(Contract ARPA-SD-101)
(AD-699938) Avail: CFSTI CSCL 11/7

Summarized is the research carried in the materials sciences program at the University of Maryland. Research was concerned with: Laser science and technology, Synthesis and structure of materials, High pressure studies and effects, Studies of superconducting materials, Mechanical properties of metals and alloys, Optical and spectroscopic properties of materials, Magnetic and electromagnetic properties of materials, Chemical and thermodynamic properties of materials. TAB

N70-36633# National Science Foundation, Washington, D.C.
AMERICAN SCIENCE MANPOWER, 1968
1969 283 p refs
(NSF-69-38) Avail: SOD $2.00

Statistical data on the supply, utilization, and characteristics of scientific manpower resources are presented, based on the 1968 National Register of Scientific and Technical Personnel. Information on education, specialization by work activity and field, type of employer, salary, age, sex, and other factors, is analyzed. The data are part of a longitudinal file covering such subjects as geographic mobility, mobility among types of employers, and carrer patterns in terms of training and employment. Almost 298,000 scientists (9 percent females) were canvassed, three-fifths of these registrants were in the physical and mathematical sciences, one-fifth in the life sciences, and the remainder in the behavioral and social sciences. J.M.

N70-36634# National Center for Atmospheric Research, Boulder, Colo.
NCAR RESEARCH AND FACILITIES PROGRAMS Annual Report, 1969
May 1970 127 p refs
Avail: CFSTI

Activities and progress are reported for research programs in atmospheric sciences, atmospheric observation techniques, and interactions with universities. Studies on planetary-scale and mesoscale motions, and convection and turbulence are discussed in addition to precipitation from convective clouds, atmospheric transport, atmospheric chemistry, and solar flare activity from Apollo 11 samples. Research aviation, scientific balloon, computing, design and prototype development, and field observing facility activities are reviewed along with the global atmospheric measurements program. Research activities on the solar interior, the photosphere and the chromosphere, the corona, solar activity, solar-terrestrial geomagnetism, aeronomy, and magnetospheric physics, laboratory astrophysics, climax observing station, and local site survey are mentioned. J.M.

N70-36662# Atomic Energy Commission, Oak Ridge, Tenn. Div. of Technical Information Extension.
ENGINEERING MATERIALS LIST, SUPPLEMENT 57
Richard J. Smith, Francis L. Sachs, and Willie E. Clark, eds. Apr. 1970 40 p refs
Avail: CFSTI

Twenty-three packages of engineering drawings and specifications are presented for: 12-inch fast gate valve; proportional water samplers; isokinetic probe; thermoluminescent tissue equivalent dosimeter; ATR primary coolant system 20-inch check valve; chassis assemblies for rack mounting; infrared displacement transducer; short-term tensile tester; passive accelerometer system; automatic volumetric flow system; eddy-current angular displacement measuring system; standard FLOGIC cards; uranium colorimeter; refrigerated liquid hydrogen target system; opto-electronic feedback preamplifier; spark chamber reader system; data link transmission system, ICIOB terminator; thermal neutron survey meter; derivative computer for thermogravimetric analysis; biaxial stress testing system; and whole-body-counter pallet drive. A subject index is included. NSA

N70-36783*# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Computing and Information Sciences.
AUTOMATED CONTEXTUAL ANALYSIS OF THEMATIC STRUCTURE IN NATURAL LANGUAGE
L. D. Misek May 1970 73 p refs
(Grant NGR-36-027-001)
(NASA-CR-112366; Rept-1103) Copyright. Avail: CFSTI CSCL 05G

This report surveys a natural language text analysis designed and implemented. Under development is the software to interface natural language data bases with various analytic subroutines and to implement a network by which theme and structure are coded, culled, and documented in patterns supported by metric evidence. The programs currently in use are SORTWAY, TROPTRAK, CRIC-8 and critic. For each of these analytic algorithms, only the broad organizational features of output texts are referenced by sample. Author

N70-36810# Peat, Marwick, Livingston and Co., Washington, D.C.
NORTHEAST CORRIDOR TRANSPORTATION: PROBLEMS AND PROSPECTS Final Report
Dec. 1969 109 p
(Contract DOT-FR-9-0017)
(PB-190930; NECTP-210) Avail: CFSTI CSCL 13B

The report contains four parts, each based on a region within the Corridor. New York is examined first because of its impact on the remainder of the region. The other three regions covered are: Delaware Valley, Baltimore-Washington and New England. Each region is examined on the basis of four central points. A preliminary investigation of historic growth patterns is followed by demand for transportation. The level of service in each region now and in the future is examined. Author (USGRDR)

N70-36811# MITRE Corp., Baileys Crossroads, Va.
COST ANALYSES FOR NECTP. VOLUME 2: AIR AND HIGHWAY MODES
William Leathwood and John L. Vialet, Jr. Dec. 1969 74 p refs
(Contract DOT-7-35248)
(PB-190943; MTR-4105-Vol-2; (NECTP-223-Vol-2) Avail: CFSTI CSCL 13B

The document contains a description of the cost analysis of conventional aircraft, vertical and short take-off and landing aircraft, automobile, and intercity bus modes done in support of the Northeast Corridor Transportation Project of the U.S. Department of Transportation. It presents cost characteristics of each mode, relation to other Northeast Corridor models, and appraisal of results. Author (USGRDR)

N70-36832*# Denver Research Inst., Colo. Industrial Economics Div.
PROJECT FOR THE ANALYSIS OF TECHNOLOGY TRANSFER Quarterly Report, 1 Jan. – 31 Mar. 1970
May 1970 117 p
(Contract NSR-06-004-063)
(NASA-CR-112363; QR-1) Avail: CFSTI CSCL 05A

Forty cases in which NASA-developed technologies have been transferred to other sectors of the United States economy are documented in case report form. A comparison of persons requesting technical support packages (TSP's) from NASA field centers with those ordering them from the Clearinghouse for Federal Scientific and Technical Information showed that the two groups (1) differ substantially in terms of the organizations by which they are employed and the technical subject matter they requested, and (2) are nearly identical in terms of the benefits they associate with TSP use, difficulties encountered, and overall TSP ratings. Major progress occurred in developing a comprehensive filing system which documents transfers of NASA-developed technology and provides quick access to all known transfers by industry, firm size, location, technical subject matter, and application area. Author

N70-36876*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACE PROGRAMS SUMMARY NO. 37-62, VOLUME 3 FOR THE PERIOD 1 FEBRUARY–31 MARCH 1970. SUPPORTING RESEARCH AND ADVANCED DEVELOPMENT
30 Apr. 1970 309 p refs
(Contract NAS7-100)
(NASA-CR-112316; JPL-SPS-37-62-Vol-3) Copyright. Avail: CFSTI CSCL 05B

The research projects reviewed pertain to the fields of space sciences, telecommunications, guidance and control, engineering mechanics, astrionics, environmental sciences, propulsion, and mission analysis. For individual titles, see N70-36877 through N70-36899.

N70-36898*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Mission Analysis Div.
SYSTEMS ANALYSIS RESEARCH
In its Space Programs Sum. No. 37-62, Vol. 3, 30 Apr. 1970 p 282–289 ref (See N70-36876 20-34)
Copyright. Avail: CFSTI CSCL 12A

A brute-force method is used to determine the minimum sum-of-the-squares estimate of a parameter. Starting with the assumptions that the a priori values of the parameter to be estimated are sufficiently close to true values that the linear theory is assumed; it is shown that expressions can be written for weighted least-squares problems. The equivalence of the brute-force estimates is also demonstrated algebraically. F.O.S.

N70-36927*# Colorado State Univ., Fort Collins. Human Factors Research Lab.
THE ROLE AND FUNCTION OF ACADEMIC DEPARTMENT CHAIRMEN IN TWO LAND-GRANT INSTITUTIONS
C. O. Neidt and Ross Loomis [1970] 97 p refs
(Grant NGL-06-002-038)
(NASA-CR-112866) Avail: CFSTI CSCL 05A

A sample of faculty and administrators at two land-grant universities ranked a series of questionnaire items reflecting characteristics of effective departmental chairmen. There was a marked tendency to agree on what chairman characteristics were most and least important. Agreement held up across differences in rank, college, broad academic discipline groups, years of experience, and number of publications. Characteristics ranked as important included support of good teaching, reputation for achieving goals, ability to recruit promising faculty, good organization of faculty duties, a personal reputation for scholarship, and a capacity for decisive thinking and action. Typical low rated characteristics involved being highly identified with one's own discipline; identifying as one of the faculty, first among equals; maintaining a low turnover rate in faculty; and fund raising along with other extradepartmental involvement with broader university groups, community organizations, and government agencies. Author

N70-36948*# Congress. House. Committee on Appropriations.
DEPARTMENT OF TRANSPORTATION AND RELATED AGENCIES APPROPRIATIONS FOR 1971. PART 1: CIVIL AERONAUTICS BOARD, FEDERAL HIGHWAY ADMINISTRATION, FEDERAL RAILROAD ADMINISTRATION NATIONAL TRANSPORTATION SAFETY BOARD, UNITED STATES COAST GUARD, WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY
Washington GPO 1970 1301 p refs Hearings before Comm. on Appropriations, 91st Congr., 2d Sess., Feb. – Mar. 1970
Avail: Subcomm. of the Comm. on Appropriations

Hearings on budget requests are presented for each agency. Operational expenses and salaries, research and development, personnel management, and special projects are covered. For Part 2 see N70-36161. N.E.N.

N70-36959* + National Aeronautics and Space Administration Langley Research Center, Langley Station, Va.
RESEARCH IN AERONAUTICS AND SPACE
Mar. 1969 195 p
(NASA-TM-X-65099) Avail: CFSTI CSCL 05B

The aeronautical research program is aimed at improving the safety, utility, and effectiveness of aircraft over the entire speed range. The classes of aircraft considered in the Langley program are: (1) V/STOL and helicopter; (2) general aviation; (3) subsonic; (4) supersonic, and (5) hypersonic aircraft. The aeronautics research program is largely accomplished in-house with wind tunnels, other ground-based facilities and with the use of full-scale aircraft. Needs of both civil and military aeronautics are considered in the Langley program. The Langley space research program is concerned with the following classes of vehicles: (1) Launch vehicles; (2) manned spacecraft ; (3) unmanned spacecraft; and (4) scientific payloads. This program is accomplished through contract with significant in-house involvement of staff and facilities in supporting research and technology. The technical competence of the Center is also utilized to manage large space flight projects such as Lunar Orbiter and Viking directed toward the achievement of major national goals in space. Author

N70-37018*# ASLIB, London (England).
FIVE SPECIALISED INFORMATION CENTRES
S. E. Robertson and R. Reynolds Office for Sci. and Tech. Inform. Oct. 1969 59 p refs Sponsored by Office for Sci. and Tech. Inform.
(Contract SI/44/13)
(OSTI-5050) Avail: CFSTI

Since 1965, the U.K. Office for Scientific and Technical Information (OSTI) has supported a small number of specialised information centres. These centres acquire all material likely to contain information of interest to users working within their specialised fields, arrange for its evaluation by specialists, and organise this material for retrieval and for dissemination through current awareness publications, specialised bibliographies, answers to enquiries and "state of the art reports." Five centres were visited by an ASLIB team and this summary of their functions and experience was prepared. The five centres were the Biodeterioration Centre, the Intestinal Absorption Information Centre, the Rock Mechanics Information Centre, the Mass Spectrometry Data Centre and the Biomedical Engineering Centre. Author (ESRO)

N70-37042# Saclant ASW Research Center, La Spezia (Italy).
THE ASW ROLE IN THE LOGISTIC SUPPORT OF GROUND FORCES: AN APPLICATION OF LANCHESTER THEORY
M. Bresson 15 Jun. 1968 85 p refs
(Saclantcen-TR-117) Avail: CFSTI

On the basis of the observed slowing down of land offensives, a model is developed to explain the logistical constraints that impose an upper limit on the tactical or strategic capabilities of ground forces. The model is then generalized to cover not only the space/time constraints within the land theater itself, but also those constraints that are imposed by the availability of supplies. This leads to the development of a global model showing the interactions between land and naval battles for conditions in which the main source of supply of large land units depends on the safe arrival of transport ships. The role of antisubmarine warfare in the logistic support of ground forces is thereby demonstrated. Author (ESRO)

N70-37060# National Bureau of Standards, Washington, D.C.
ENVIRONMENTAL POLLUTION: A SELECTIVE BIBLIOGRAPHY
May 1970 34 p refs
Avail: CFSTI

Most reports listed in this bibliography result from federally sponsored research by such departments and agencies as HEW, Interior, AEC, NASA, Defense, Transportation and others. These reports were selected from those appearing in announcement journals during the period 1968 through April 1970. Author

N70-37070*# Scientific Translation Service, Santa Barbara, Calif.
DEVELOPMENT OF INSTALLATIONS FOR DIRECT CONVERSION OF HEAT INTO ELECTRICAL ENERGY BY MEANS OF MHD GENERATORS AND OTHER NEW ENERGY DEVICES
In its The Inst. of High Temp. of the USSR Acad. of Sci. The Most Important Results of Sci. Res. in 1969 Aug. 1970 p 45–83 refs (See N70-37066 20-33)
Avail: CFSTI CSCL 10A

Research connected with the development of stationary electrical power plants is reported and includes the following: (1) Investigations were conducted on metallic electrodes of steel and copper and also on ceramic electrodes of silicon carbide and zirconium dioxide. (2) Experimental equipment was built for studying the dynamics of processes adjacent to electrodes and permitting electro-optical detection of spots with time resolutions down to 10 to the minus 8th power sec with simultaneous measurement of charged particle concentration in the cathode region with time resolutions as low as 5 x 10 to the minus 8th power sec. (3) Investigation of the high-current discharge on electrodes covered directly with an additive in the MHD generator channel demonstrated that the intensity of the electrode disintegration process by pinched discharge is reduced by a factor of ten. (4) Thermal efficiency studies were made of the combined open cycle MHD power plants with various methods of achieving the high temperatures of the combustion products. (5) Theoretical and experimental studies of problems connected with the development of liquid metal MHD power plants were conducted. D.L.G.

N70-37083*# Northwestern Univ., Evanston, Ill. Dept. of Industrial Engineering and Management Sciences.
AGING, CREATIVITY, INTER-SPECIALITY MOBILITY, RETRAINING, AND TECHNICAL OBSOLESCENCE OF SCIENTIFIC AND TECHNICAL PERSONNEL: A SELECTED BIBLIOGRAPHY
Richard T. Barth Jan. 1970 22 p refs
(Grant NGR-14-007-062)
(NASA-CR-112778) Avail: CFSTI CSCL 05I

The entries were selected on the basis of their relevance to the following typical researchable and organizational design topics: how to help engineers and scientists change fields or specialities in midcareer; the effect of age on the scientist's and engineer's ability to redirect or change his career; technical obsolescence, how it should be measured, and how it is related to organizational aging; the role of continuing education in preventing technical obsolescence; and the concerns of research scientists and engineers who are reassigned into development activities. Autho

N70-37109# National Science Foundation, Washington, D.C. Office of Economic and Manpower Studies.
FEDERAL FUNDS FOR R AND D CONTINUE TO REMAIN LEVEL
14 Aug. 1970 4 p
(NSF-70-28) Avail: Issuing Activity

The decrease in government support for research and development in the United States is reported. A tabular breakdown is given which shows the amount of basic and applied research, as well as development, and funds provided by the Federal Government, according to the agency receiving the funds. The major support agencies include the Department of Defense, NASA, and the Atomic Energy Commission. R.B.

N70-37141# Grenoble Univ. (France). Faculte de Droit.
LEGAL PROBLEMS RELATING TO SPACE (LEGAL PRINCIPLES AND EFFORTS OF CODIFICATION BY THE NATIONS) [LES PROBLEMES JURIDIQUES DE L'ESPACE (PRINCIPES JURIDIQUES ET EFFORTS DE CODIFICATION DE L'ONU)]
Akira Matsui (Ph.D. Thesis) 16 Jun. 1970 203 p refs in FRENCH
Avail: CFSTI

This report summarizes the work of the U.N. Committee on the Peaceful Uses of Outer Space (COPUOS) and discusses the resolutions adopted by the General Assembly in 1962 and 1963. The treaty governing the exploration and the use of outer space including the moon and other celestial bodies, the agreement on the rescue of astronauts, and the draft conventions on responsibility for damage are also discussed. ESRO

N70-37142# Cambridge Language Research Unit (England).
THE USE OF AUTOMATICALLY OBTAINED KEYWORD CLASSIFICATIONS FOR INFORMATION RETRIEVAL Final Report
K. Sparck Jones and D. M. Jackson Feb. 1969 47 p refs
Sponsored by Office for Sci. and Tech. Inform.
(ML-211; OSTI-5038) Copyright. Avail: CFSTI

This report deals with the automatic construction of keyword classifications and their use in information retrieval. It discusses the possible characteristics of such classifications and potential ways of using them, and describes the various approaches to classification in terms of an overall frame of reference in which several types of classification are distinguished. The results of experiments using a collection of documents and test requests obtained from the ASLIB Cranfield project are presented, and it is concluded that automatic classifications which lead to noticeable improvements in retrieval performance over those obtainable with unclassified terms can be set up. Author (ESRO)

N70-37166# Grumman Aircraft Engineering Corp., Bethpage, N.Y. Research Dept.
ADVANCED CONCEPTS IN REFUSE MANAGEMENT
A. Hershaft Aug. 1970 18 p refs Presented at the Natl. Pollution Control Conf. and Exposition, San Francisco, 3 Apr. 1970
(RM-485J) Avail: CFSTI

The failure of solid waste management technology to deal adequately with the rapid proliferation of municipal refuse has created a serious refuse management crisis in nearly every major population center. A solution can be attained by addressing the technology of waste collection, processing, and disposal, on the one hand, the waste production processes on the other. The presentation of the first approach begins by setting the municipal refuse crisis within the overall context of solid waste management. Advanced concepts in refuse collection are examined, including auxiliary and automatic pickup vehicles, pneumatic systems, and pipelines. The review of advanced concepts in refuse processing covers fragmentation, sorting, compaction, and high-temperature incineration. Several refuse transport and disposal concepts are outlined. A review of proposals for improving refuse management operations concludes the treatment of the first approach. Discussion of the second approach considers such topics as curtailment of waste products, disposability through design, and means of implementation. Author

N70-37175# Civil Aeronautics Board, Washington, D.C. Costs and Statistics Div.

HANDBOOK OF AIRLINE STATISTICS: DATA FOR INDIVIDUAL CARRIERS, 1959–1968 DATA FOR CARRIER GROUPS, 1926–1968

Feb. 1970 541 p refs *Its* Handbook of Airline Statistics No. 7

Avail: SOD $8.00

Statistical and historical data through 1968 are presented, based on reports by carriers and records of the Civil Aeronautics Board. The tables cover passenger and freight revenues, expenses, and other air transport data. N.E.N.

N70-37202# Oxford Univ. (England). Magdalen Coll.

A COMPARATIVE EVALUATION OF INFORMATION RETRIEVAL FROM NATURAL LANGUAGE TEXT. A STUDY OF LEGAL INFORMATION Final Report, 1 Jun. 1966 – Feb. 1969

C. F. H. Tapper Jan. 1970 38 p Sponsored by Office for Sci. and Tech. Inform.

(OSTI-5061) Avail: CFSTI

This report is concerned with the feasibility and evaluation of information retrieval from natural language texts in the legal field. It deals with data preparation (punching and checking of cards and tapes); search preparation based on word occurrence; programming and retrieval; thesaurus compilation and results. It was concluded that the experiment was successful. ESRO

N70-37215# National Research Council of Canada, Ottawa (Ontario).

QUARTERLY BULLETIN OF THE DIVISION OF MECHANICAL ENGINEERING AND THE NATIONAL AERONAUTICAL ESTABLISHMENT, 1 JANUARY–31 MARCH 1970

31 Mar. 1970 87 p refs

(DME/NAE-1970(1)) Avail: CFSTI

Radiation hazards involving supersonic transports are assessed on the basis of environmental and biological dose/effect relationships, and a tidal study of the St. Lawrence River using hydraulic and mathematical models is discussed. Other laboratory projects are mentioned. J.M.

N70-37243*# California Univ., Berkeley.

THE OAKLAND PROJECT: ACTION AND RESEARCH IN A CORE CITY Final Report

Frank Levy, Judith May, Jesse Mc Corry, Arnold Meltsner, Jeffrey Pressman et al 1970 21 p refs

(Grant NGR-05-003-125)

(NASA-CR-112767) Avail: CFSTI CSCL 05K

The initial results are presented of a program aimed at finding ways of relating the university to problems of a core city. A specific objective was to meet some of the city of Oakland's most pressing needs and to make suggestions that could be implemented and, if successful, transferred to other urban areas. The project's scope involved combining policy analysis, action in implementing proposals, training of graduate students, teaching new undergraduate courses, and scholarly studies of urban politics. Efforts are reviewed of the project participants in providing assistance to the city government in the policy areas of revenue, police, personnel, federal aid, education, and libraries. The problems confronted in these areas and the approaches taken by the participants are described along with recommendations for ultimate solutions. D.L.G.

N70-37286# Bochum Observatory (West Germany).

INSTITUTE FOR SPACE RESEARCH Annual Report 1969 [JAHRESBERICHT 1969 DES INSTITUTS FUER WELTRAUMFORSCHUNG]

Heinz Kaminski 1970 20 p refs In GERMAN

Avail: CFSTI

This annual report for 1969 deals with satellite-tracking, Apollo 11 observations, satellite solar radiation data, and satellite studies of submarine structures, ice and snow and terrestrial infrared radiation. ESRO

N70-37290* Ohio State Univ., Columbus. Computer and Information Science Research Center.

INFORMATION SCIENCE AS AN AID TO DECISION-MAKING

Ronald L. Ernst and Marshall C. Yovits Sep. 1969 26 p refs

(Grant NSF GN-534.1)

(PB-189666; CISRC-TR-69-13) Avail: CFSTI CSCL 05A

The organization of two important areas which interact strongly: information science and decision-making is considered. Both are commonly and extensively used in a variety of ways and share an equally commonly and extensively used variety of definitions. In order to organize or to relate information science and decision making to each other, a number of important criteria must be considered. For example, the organization or interrelationship should have generality, applicability, utility, reality, and the potential for quantification. A generalized information system defined in detail, satisfies all of these criteria. Author (USGRDR)

N70-37343# Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.

A REVIEW AND COMPARISON OF SELECTED UNITED STATES ENERGY FORECASTS

Dec. 1969 96 p Prepared for the Executive Office of the President, Office of Sci. and Technol.

(PB-189938) Avail: $1.00; CFSTI CSCL 05A

The report collects in a single volume the essence of nineteen energy forecasts published in recent years by private organizations, government agencies, and individuals and compares their forecast values, assumptions, and methodologies. The study evaluates existing energy forecasts for policy planning purposes. The forecasts were prepared for different purposes and often reflect differences in terminology, coverage, and assumptions. The comparative tables in the report take these differences into account insofar as possible. USGRDR

N70-37377# National Air Pollution Control Administration, Raleigh, N.C. Office of Research Grants.

HIGHLIGHTS OF SELECTED AIR POLLUTION RESEARCH GRANTS

May 1970 53 p refs

(PB-191273; NAPCA-Pub-AP-70) Avail: SOD $0.70; CFSTI CSCL 13B

The contents include: List of principal investigators and institutions; Effects of air pollution on human health, welfare, or productivity; Effects of air pollution on agriculture; Economic and political studies; Analyses and physiochemical investigations; Development of analytic methods and equipment; Meteorology; Description and control of air pollution sources; Communication. Author (USGRDR)

N70-37457# TRW Systems Group, Redondo Beach, Calif.
SYSTEM EFFECTIVENESS STUDIES Final Report
Nov. 1969 71 p ref
(Contract DOT-C-353-66)
(PB-191323; TRW-06818-W002-R0-00; FRA-RT-70-32) Avail: CFSTI CSCL 13B

A computerized model was constructed which employs selectable reliability and failure distributions to interrelate the performance of a high speed ground transportation system in terms of adherence to established schedule and the various reliability and failure parameters on the subsystem and component level. The model is based upon an analytic combination of the conditional reliability and failure distribution. Three train failure modes, distinguished by the limiting speed encountered for the various component failure contributions, are considered. These lead to the overall probability of reduced operating performance for a train and, finally, to the probability distribution of delays in a network. The computer output information is prepared so as to be compatible input to a TRANSIM simulation program developed under an associated system engineering support task. Author (USGRDR)

N70-37469*# Southeastern State College, Durant, Okla. Technology Use Studies Center.
TECHNOLOGY UTILIZATION IN A NON-URBAN REGION: FURTHER IMPACT AND TECHNIQUE OF THE TECHNOLOGY USE STUDIES CENTER Final Report
May 1970 65 p refs
(Contract NSR-37-004-009)
(NASA-CR-112841) Avail: CFSTI CSCL 05A

The techniques employed in serving industrial clientele in a non-urban region are identified. The techniques described have been developed over six years of intensive field work. Both successful and unsuccessful techniques are shown along with possible reasons for success or failure. Five cases, representing a cross section of TUSC industrial clients, are shown, along with descriptions of library techniques and liaison operations with other agencies. Author

N70-37485# Bureau of Reclamation, Denver, Colo. Office of Engineering Reference.
CASE STUDY: EXPANSION OF AN SDI SYSTEM
Warren B. McBirney Nov. 1969 21 p
(PB-188978; OER-2) Avail: CFSTI CSCL 5B

In 1968 the SDI system of the Bureau of Reclamation, Department of the Interior, was expanded to begin a similar service for the Water Resources Scientific Information Center (WRSIC). Design of Reclamation's system is discussed and adaptation to WRSIC described, resulting in combined systems serving nearly 3000 engineers and scientists on an individual basis. The case study approach is used to trace technical and management considerations. Author (USGRDR)

N70-37491# Brigham Young Univ., Provo, Utah. High Pressure Data Center.
HIGH PRESSURE BIBLIOGRAPHY 1900–1968. VOLUME 1, SECTION 1: BIBLIOGRAPHY. SECTION 2: AUTHOR INDEX
Leo Merrill Apr. 1970 692 p refs
(Contract NBS-CST-491)
(PB-191174; NBS-OSRDB-70-1-Vol-1) Avail: CFSTI HC $10.00/MF $0.65 CSCL 20L

The bibliography deals with many of the major research areas in the fields of chemistry, physics, geology, mechanics and biology. The main emphasis is on work above 5 kilobar (5 x 10 to the 8th power Neuton/sq m), and includes both static and dynamic pressure studies. This volume is comprised of the bibliography and author index. Author (USGRDR)

N70-37498# East Central Florida Regional Planning Council, Titusville.
A PLAN FOR THE FUTURE. REPORT 7: GENERAL AVIATION AIRPORT SYSTEM
Feb. 1970 8 p Sponsored by HUD Prepared in cooperation with Orange-Seminole-Osceola Planning Comm., Orlando, Fla.
(PB-191235) Avail: CFSTI CSCL 05A

The report summarizes the planning study of general aviation in Orange, Seminole and Osceola Counties. A detailed technical report is available which presents the entire study including rationale supporting the major recommendations. Author (USGRDR)

N70-37567*# Harvard Coll. Observatory, Cambridge, Mass.
LUNAR NOMENCLATURE Interim Report
Donald H. Menzel 17 Aug. 1970 48 p Presented at 14th Gen. Assembly of the IAU, Brighton, Engl., Aug. 1970
(Grant NGR-22-007-194)
(NASA-CR-112844; IR-2) Avail: CFSTI CSCL 03B

The Working Group on Lunar Nomenclature of the International Astronomical Union, originally assigned selected names to features on the far-side of the Moon in a semi-alphabetic arrangement. This plan was criticized, however, by lunar cartographers, as offering a practical danger of confusion between similar nearby names, particularly in oral usage by those using the maps in lunar exploration. The Working Group has accepted the possible validity of the criticism and reassigned the names in a more or less random order, as preferred by the cartographers. They also deleted from the original list, several names that too closely resembled others for convenient oral usage. The solutions reached by the Working Group to this and several other remaining problems are reviewed, including that of naming lunar features for living astronauts. Biographical notes are given for identification of the persons whose names are proposed for features on the far-side of the Moon, and data are included on names previously assigned by the IAU to craters on the far-side. Author

N70-37594# Congress. House. Committee on Science and Astronautics.
THE MANAGEMENT OF INFORMATION AND KNOWLEDGE
Washington GPO 1970 137 p refs Presented at the 11th ann. meeting of the Panel on Sci. and Technol. with the Comm. on Sci. and Astronaut., 91st Congr., 2d Sess., Feb. 1970
Avail: SOD $0.60 CSCL 05B

Selected papers are presented on information management topics including: post industrial society in the United States and economic history with comparisons to Japan and Germany, managing modern complexities and forecasting with computers, self-liquidating ideals in American attitudes toward technology, individual privacy, self image, and obsolescence in respect to computer and communications technology, mass media and communications systems, education as an information system, and policy directions for education in post-industrial America. J.M.

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NEW NASA PUBLICATIONS

NASA Scientific and Technical Reports and Publications for 1969: A Selected Listing (NASA SP–7035)

Citations plus abstracts for all formal NASA publications that were announced in *STAR*, plus NASA-employee authored items that were announced in *IAA* (*International Aerospace Abstracts*) during calendar year 1969. A total of 2688 abstracts are included. Arrangement is by *STAR* subject categories, Indexes (by subject, by personal author, by corporate source, by report number, and by accession number) are included. *Paperbound.* 952 pp. Available from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for $7.50.

A Ray Tracing Digital Computer Program for the Study of Magnetospheric Duct Propagation (NASA SP–3055)

By JAYARAM RAMASASTRY AND EDWARD J. WALSH

This publication documents and discusses a digital computer program used to conduct ray-tracing of electromagnetic waves in the magnetosphere. Included is a general description of the program and its capabilities; information necessary for a non-programmer to run the program; and a programming manual describing the program structure. The program is designed to operate in the IBM 7094 IBSYS environment. It is written in Fortran IV but utilizes a MAP assembler subroutine to integrate the differential equations. *Paperbound.* 304 pp. Available from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Va. 22151, for $3.00.

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